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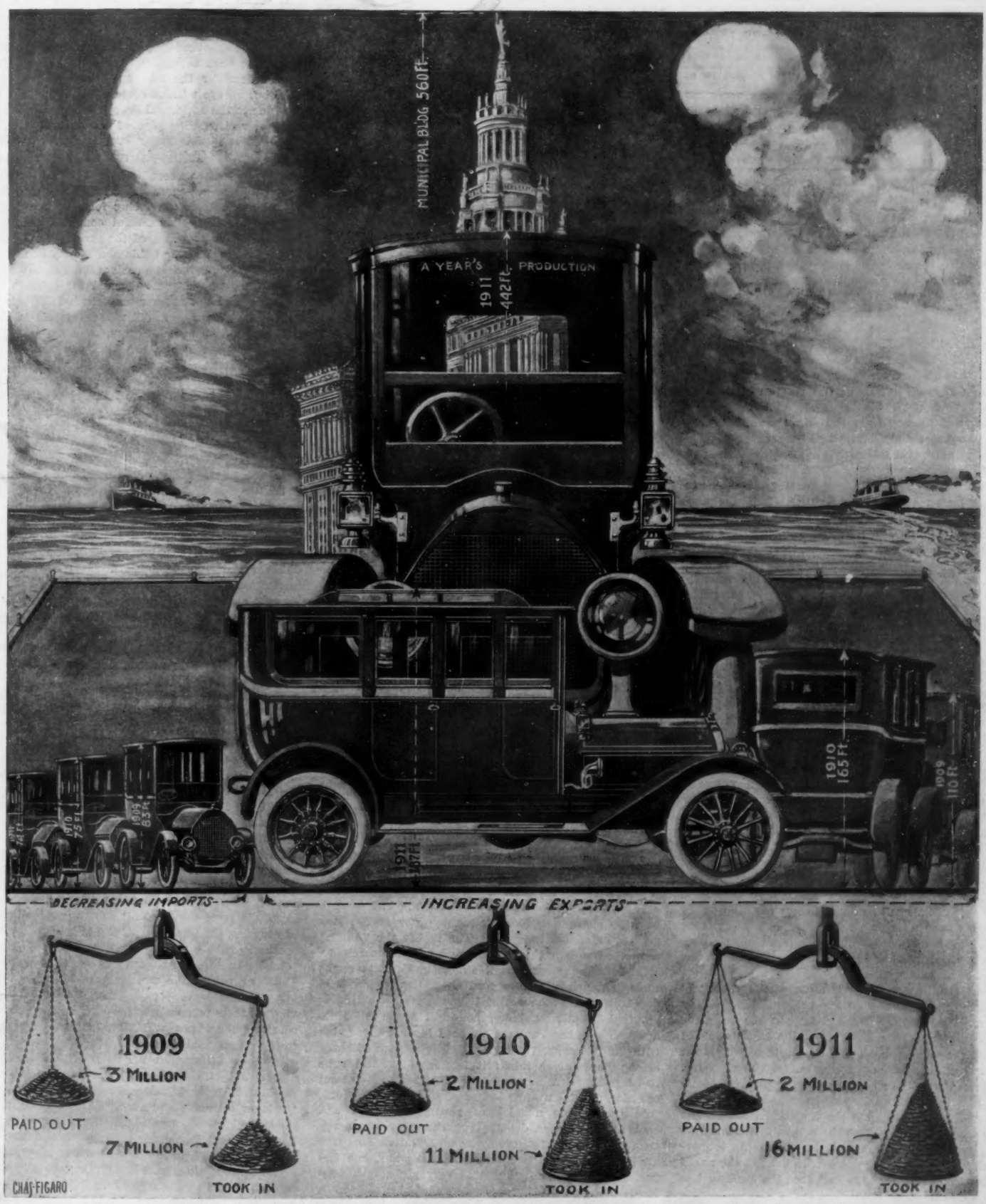
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 3.] NEW YORK, JULY 20, 1912 [10 CENTS A COPY $3.00 A YEAR



Last year's production of automobiles in the United States and a comparison of our increasing exports with our decreasing imports.

THE GROWTH OF THE AUTOMOBILE INDUSTRY.—[See page 63.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 20, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

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Subscription one year $3.00
Postage prepaid in United States and possessions
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Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid. 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $3.00
Scientific American Supplement (established 1876) . " 5 00
American Homes and Gardens . . . . . " 3.00
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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Human Fallibility and the Automatic Stop

THE theory of the automatic block signal system as applied to railroads for the prevention of collisions is perfect Its practice as carried out day by day on the railroads of the country, proves that it is not the absolute preventive of collision which we hoped it would prove to be. From time to time there have occurred serious railroad disasters which an effective working of the block signal system should have rendered impossible. The latest and most frightful of these were the rear end collisions at Corning, New York, and Latrobe, Pennsylvania, when nearly one hundred people lost their lives, and an even larger number were injured.

It is not sufficient to say that these accidents were due to the human element, which can never be controlled by any mechanism, howsoever ingenious and effective it may be. A block signal system, if it is to do its work, must make it impossible for two trains to be in the same block at the same time. This, the present system cannot do in those cases where there is negligence on the part of the operating staff.

In the Corning disaster, the engineer ran by two block signals, and appears to have taken no notice of a third signal, placed in the rear of the stalled train by the brakeman. In this case, the collision was due either to the carelessness, wilful disobedience, or mental and physical incapacity of the engineer. Just how he came to run by these signals will be shown during the official investigation.

The point we wish once more to emphasize is that the block signal system, as at present laid out and operated, is not absolutely effective. It lacks one element, simple and readily installed, which, if it were present, would render block signalling absolutely effective as a preventive of collision. We refer to the automatic stop.

The automatic stop is as essential to a properly-constructed block signal system as the trigger is to the gun. This gruesome Corning disaster simply emphasizes a fact which this journal has many times proclaimed in the past few years, namely, that the excellent idea embodied in block signalling can be made absolutely effective only by rendering it mechanically impossible for a train to run by a signal.

It is "up to" the railroads to install the stop on all important lines carrying mixed traffic. At present they do not look favorably upon this mechanism. They dislike the first cost and they have an equal dislike for the cost of maintenance.

We commend to the consideration of the Interstate Commerce Commission—that fine body of men which is doing such magnificent work, both for the railroads and its patrons—the necessity for the installation of the automatic stop on all important lines carrying a heavy and mixed traffic of express and passenger trains. The device should be so arranged that when the semaphore arm is up, the trip will be up. Moreover, the trip should operate to close the throttle and apply the brakes simultaneously. Also there should be some self-locking recording arrangement, by which the locomotive, when it has been tripped carries back to the round house a visible record of the fact that the engineer has run by a signal.

Railroad managers complain bitterly of the lax ideas of discipline which prevail among the operatives of American railroads, and name this as a fruitful cause of accidents. The best corrective is to place the careless operator under automatic control.

The Fate of Vaniman

ALTHOUGH there was no survivor to the dreadful catastrophe that blotted out what has been the most determined attempt so far to supply America with at least one dirigible of businesslike proportions, it is by no means so difficult to point out defects in the "Akron," which rendered it liable to such an accident.

Building a dirigible balloon of large size is a problem that bristles with engineering difficulties, especially if the balloon is to be non-rigid, as was the "Akron." It calls for a man who is not only a clever mechanician and inventor, but an architect and civil engineer of high order.

The large European non-rigid dirigibles have been developed step by step. The first Gross, Parseval, and Lebaudy airships were very small; the first "Ville de Paris," a mere enlargement of the Santos Dumonts, was a complete failure.

Vaniman began with the size of almost the largest European non-rigid dirigibles. It did not follow any European model. The shape of the envelope did not show any "speed lines" (such as those developed in the laboratories of Europe); there were no adequate steadying fins; the rudders were too small; and while the 280 horse-power propelling plant was rather weak for the displacement so that the speed could only be quite moderate, there were no aeroplanes to counteract the changes in the gas lift, as in the large French dirigibles with moderate power.

We must remember, however, that the "Akron" was not built to sail over land, which explains the departure from European design. It was intended particularly for a transatlantic venture, and as economy of fuel was a vital factor, Mr. Vaniman intended to drift as much as possible. To attempt to drive the airship across the ocean at a speed of forty to fifty miles an hour, such as attained by European dirigibles, would have required more fuel than he could very well have carried. Mr. Vaniman was, therefore, trying to build a new type of airship which we may call a "drifting dirigible," contradictory as the term may seem. Such being the case it was not necessary for him to use more than one or possibly two engines at a time, as he desired to make little more than steerage way. With a weak power plant and a machine that was to be blown by the winds, the "aeroplane lift" idea was discarded. Instead, Mr. Vaniman depended upon driving his airship down by means of orientable propellers and also by pumping air ballast in the ballonets until he could come near enough to the surface of the sea to pick up water ballast in his "hydrolevator."

It is probable that Vaniman, when he found the hot July sun squeezing all the air out of the air ballonets, against the heavy weight on their safety valves, and trying to expand the gas still further, depended on preventing further ascension by keeping the gas forcibly in the envelope under compression. Just why he did not drive the machine down with his orientable propellers who can say? He had two sets of them, one pair driven by an 80 horse-power engine and another by an engine of 100 horse-power. It was the first ascension of the "Akron" on a hot summer day. Accounts clearly establish the fact that the airship, when the sun gained its full power, began to rise steadily until everybody wondered about the unprecedented and uncalled for altitude. It ascended until all the air was forced out of the ballonets; then it burst. It is now evident that the first reports were erroneous. The gas was not set on fire. The uncharred envelope is conclusive evidence of the fact that fire played no part in the catastrophe.

The whole occurrence is a close parallel to the fate of Oskar Erbsloeh's dirigible in 1910, that burst in the air, when it suddenly emerged from a dense fog into sunshine, killing all aboard. Only in Vaniman's case it came more gradually; in place of a German fog there was the characteristic American summer haze which greatly influences radiation. The higher the "Akron" ascended the more the haze thinned, and the more powerful became the sun. At this moment Vaniman ought to have pulled the valve cord energetically, but it is doubtful whether he realized how much discretion is required in piloting large, non-rigid airships. It is doubtful whether Vaniman watched his pressure gages with the unceasing vigilance which is a point of honor among Parseval captains; it is doubtful whether he had any experience as to how easily they may get out or order, unless carefully looked after (their many long, thin tubes have a trick of getting entangled and choked); it is even doubtful whether there were any such gages at all, for there was one required for every air ballonet, of which Vaniman had so many, and two or three for the gas space, and very probably he disliked the complication and depended instead on a solitary safety valve.

But, having no aeroplanes, unless he had tons of ballast, Mr. Vaniman had a reason for not opening the valve. After the high ascension a fall into the water was very likely to follow the escape of gas, and it was quite logical thus to apply to some extent the principle of the proposed "steel envelope" even to the "Akron," for the strength of whose tough silk envelope Vaniman had given as high a figure as an inch and a half of water. But without a sufficient number of absolutely reliable pressure gages, this was extremely dangerous.

Another point must be considered. The hydrogen-generating facilities at Atlantic City were rather primitive. Any remnant of acid vapor in the gas has a very fatal influence in weakening an airship's envelope. The European "giants" do not use any hydrogen made by the old acid process.

Finally, it should be pointed out that the system of air and gas valves required in a large, non-rigid airship is as formidable an engineering problem as the valves of a gasoline motor. But where a gasoline motor gets stalled when its valves fail to work properly, an airship may burst or fall.

It seems tragical that Vaniman, who has displayed exceptional ingenuity in many details, should have fallen a victim to the neglect of proven facts.

At the same time the actual cause of the disaster may have been something that we have not touched upon. Consider the first trial trip of the "Akron." Who but an eye witness could explain that the failure was due to the accidental dropping of a bag of sand on the water circulating pipe of the engine?

The Latest Triumph of Organic Chemistry

IF proof were needed of the fertility of chemical science as a source of material gains, such proof comes in most convincing form by the recent announcement of the successful completion, by a commercially sound process, of the synthesis of India rubber. The importance of this new trophy of the organic chemist requires no emphasis: the general public is well aware of the great demand for rubber, and the difficulty which has been experienced in meeting it. Prof. Hinrichsen, on another page of this issue, gives us some statistics illustrating this point.

The announcement of the synthesis of India rubber comes from the mouth of Prof. W. H. Perkin, son of the illustrious Sir William Perkin, founder of the coal tar dye industry. Mr. E. H. Strange, of the firm of Strange and Graham, of London, England, some time ago organized a group of investigators for collaboration on the problem of synthetic rubber. The list included, in addition to Prof. Perkin, Sir William Ramsay, Prof. Fernbach, of the Pasteur Institute of Paris, and Dr. F. E. Matthews. That a certain hydrocarbon, termed isoprene, was obtainable from rubber, and could, under favorable, but somewhat ill-defined conditions, be reconverted into rubber, had been known since 1875. It remained to find a cheap source of isoprene and to discover the exact conditions under which its polymerization to rubber could be positively and rapidly brought about. Both these problems have been solved by the group of chemists organized by Mr. Strange. Prof. Fernbach, as a result of some eighteen months of arduous research, has finally perfected a fermentation process by which starchy materials (a kind of skilly made from Indian corn or potatoes and water) are converted into fusel oil. The higher alcohols which are separated from this by fractional distillation are converted into isoprene by successive treatments with hydrochloric acid, chlorine and soda lime, and the polymerization is brought about by contact with metallic sodium. This reaction was accidentally discovered by Dr. Matthews, who left some isoprene in contact with metallic sodium in July, 1910, and on returning from a vacation in September found that the isoprene had turned into a solid mass of rubber.

As regards the cost of the new process, while of course at the present stage it is impossible to give any very reliable figures, the preliminary estimates are most encouraging. We are told that the higher alcohols separated from the fusel oil can be obtained at a cost of not more than $150 a ton, and it is expected that the synthetic rubber may be sold at about 60 cents per pound. Inasmuch as para rubber is now selling at $1.35 per pound, the manufacturers of synthetic rubber evidently have every cause to take an optimistic view of their prospects. It would, however, be premature to make any very positive statements with regard to the commercial situation.

It seems fitting that the name of Perkin should be associated with this achievement. Those who are familiar with the history of modern industrial chemistry know that England may well be said to have been its birthplace. It was Sir William, also Perkin, who laid the foundation stone of the edifice of the coal tar industries, which have since been reared to such magnificent proportions chiefly by German chemists and capital. In the synthesis of rubber a close race has been run, in which our English cousins have won their German competitors coming in as a close second; Prof. Harries's independent discovery of the polymerization of isoprene, though published first, was actually made months later than that of Dr. Matthews.

Engineering

Increase of the Japanese Navy.—We understand that the Minister of Marine in Japan is in favor of the building of 18 dreadnoughts of the largest size, the construction to be spread out over the seven years from 1914 to 1920. Rumor has it that in addition to the four 27,500-ton battle-cruisers now under construction, six other vessels of this class will also be built.

Warship Iceberg Warnings.—The cruiser "Birmingham" is doing good service as an ice patrol on the northern steamship route across the Atlantic. Recently this cruiser sent a radiogram, announcing the presence of three large bergs three miles west of latitude 43.03 and longitude 48.53. It stated that another huge berg had been seen fifteen miles to the southwest. The reports are sent to the Navy Department and thence to the Hydrographic Office.

American Shipbuilding.—Last year's shipbuilding, according to the statistics of the Bureau of Navigation, accounted for 1,702 new merchant ships of all descriptions, aggregating 243,792 gross tons, as compared with 1,208 ships of 203,158 gross tons, built during the year preceding. Thirty-five steel vessels were built on the Great Lakes, including two of 8,603 gross tons, the largest vessels in the lake service. Fourteen steel vessels of 30,039 gross tons, were built for the Atlantic service.

Two Battleships a Year.—It is gratifying to notice that the press of the country is supporting the United States Senate in its stand against the House of Representatives in the matter of the increase of our battleship strength. Thus, the Rochester *Times* points out that a programme of two battleships a year will not even enable this country to maintain its relative naval strength, and the San Diego *Union* shows that failure to make the customary addition of two battleships a year must ultimately cause the United States to drop from its present position to that of fourth or fifth among the naval powers.

Steady Rise of Gatun Lake.—We noted recently that two sluice-gates in the spillway dam at Gatun were opened on June 5th, when the lake stood at an elevation of 26.5 feet above sea level. These gates were closed on June 19th, and in the week following the lake had risen to elevation +29.37. The lake may now rise to an elevation +37 feet, 4 inches, at which level it will reach the sills of the guard gates of the upper locks at Gatun. It is expected that these gates, in both the easterly and westerly flight of locks, will be completed and closed before the water reaches the sills, in which case the filling of the lake may proceed continuously throughout the rainy season.

The Ever-present Rail Peril.—H. W. Belknap, Chief Inspector of Safety Appliances of the Interstate Commerce Commission, in his report on the cause of an accident on the Great Northern Railroad on December 30th last, after calling attention to the constantly increasing number of rail failures, due generally to structural defects, says "present specifications and tests, in so far as the detection of longitudinal seams within the rail is concerned, appear to be inadequate. It seems to be time that some definite action were taken toward eliminating this source of danger and securing structurally sound rails." The cause of the accident referred to was, primarily, a defective and seriously seamed 80-pound Bessemer steel rail.

Channel Steamers With Geared Turbines.—The new Channel steamers "Normannia" and "Hantonia," built for the London & Southwestern Railway Company, have been equipped with geared turbines, using a gear of the same general type as the Melville-McAlpin. They show a consumption per shaft horse-power per hour of 1.34 pounds of coal, when the vessels are being run at a maximum speed of 19 to 20 knots. The water consumption for the geared turbines was 12 pounds per horse-power per hour, as compared with 15.1 pounds in similar turbine-driven steamers of about the same size and speed, which use a direct drive. Careful observation in the passenger quarters failed to reveal any inconvenience of vibration or noise due to the mechanical reduction gear.

New Haven Electrical Equipment.—According to Mr. W. S. Murray, Electrical Engineer of the New York, New Haven and Hartford Railroad, the power house for its electrified lines between Stamford and New York has a capacity of 45,000 horse-power for the generation of single-phase current. In 1913, 552 miles of track will be electrified, including tracks in yards and the four-track system from beyond Stamford to New York. The locomotive equipment, including multiple-unit motor cars, will be 151 units, of a total capacity of 128,800 horse-power. The investment cost of the system, which is single-phase current, will be between 75 per cent and 80 per cent of the cost of an equal direct-current electrification. Mr. Murray claims that the all-day efficiency of his system is 15 per cent higher than that of a direct-current, third-rail system.

Electricity

Sheep Shearing by Electricity.—A novel application of electric power is that of shearing sheep and clipping horses. The apparatus consists of a suitable electric motor connected by a flexible shaft to the ordinary shearing tool. The motor is of the two-speed type, and can be employed also to drive a rotating brush for grooming horses, or a small emery wheel for grinding the clipper combs.

Effect of Light on the Resistance of Selenium.—The effect of light on the resistance of selenium is well known, and has been made the basis of photo-telephonic devices for transmitting sound-waves over a beam of light. It has recently been shown that the changes of conductivity in a certain variety of selenium can be explained by assuming that the light penetrates to some distance into the conducting layer. The effective depth of penetration is about 0.014 millimeters, and filing or sandblasting the selenium surface increases the conductivity.

High-voltage Transmission in England.—A pioneer installation of the Thury direct current series system of electric power transmission in London has been running steadily for about fifteen months. In this system direct current at high voltage is transmitted by two single-conductor paper-insulated underground cables. The circuit is "all-metallic" normally, but in case of breakdown of one of the cables the earth can be used as a return conductor, by permission of the municipal authorities. The cables are, however, designed to carry 100,000 volts, with special precautions against breakdown at the joints. A number of generators in series are used, having an electromotive force not exceeding 5,000 volts each, which is regarded as the limit of safe working on a single commutator.

The Magnetization of Permanent Magnets.—In the course of a lecture at the recent meeting of the British Institution of Electrical Engineers, held at Glasgow, Dr. Sylvanus Thompson stated that the permanence of magnets depended on the quality of the steel, the shape and dimensions of the magnet, the heat treatment, the maturing, the method of preserving the magnetism ("aging"), and, least important of all, the manner of magnetization. The remanent magnetism of short bars is less than that of long ones: "Short bars have no memory," as Lord Kelvin put it. A good permanent magnet steel should retain an intensity of magnetization of about 1,000 C. G. S. units, and the coercive force increases with the carbon content of the steel. The lecture included a masterly review of the properties of steel as revealed by its microstructure.

Study of Commutation by the Oscillograph.—The oscillograph study of the generation of electromotive force and current in the armature coils of electric generators gives valuable information on the proper setting of brushes, the location of interpoles, etc. A new method of studying commutation by the oscillograph is suggested involving the use of a special armature coil wound in the same slots with the working armature coil which it is desired to study and terminating in slip rings for making contact with the oscillograph circuit. It is proposed to provide an "indicating coil" of this kind, not only on special generators for teaching purposes, but also on all large machines, and on all machines working near the limits of commutation, in the course of the construction of these machines; just as the steam engine builder always provides indicator cocks on his engines.

French Aeroplane Wireless Experiments.—Some very successful experiments were made with wireless telegraphy upon aeroplanes in France at Chartres, using a biplane mounted with the new type of transmitter designed by M. Rouget. The aeroplane started from the aerodrome at Chartres with the inventor on board, piloted by Frantz. In all, a flight of about 100 miles was made, around the country, with 30 miles as the greatest distance from the center. A small wireless post had been put up at the aerodrome and the army officers thus kept in touch with the flyer. The antenna at the ground post was less than 100 feet long and was stretched at a height of 30 feet. The officers could take all the observations made by the pilot *en route* and the signals were quite clear. On the aeroplane the apparatus used an antenna wire about 100 feet in length, hanging down from one end, and the musical spark method was employed. The wireless apparatus, together with a miniature dynamo, weighs but 70 pounds. The small alternator of 200 watts and 110 volts is coupled to the aeroplane motor directly, by means of a new clutch coupler. A small transformer raises the voltage and thus supplies 30,000 volts to the apparatus for charging the condenser. In M. Rouget's new design, all the high tension wiring is localized in a small space so as not to endanger the pilot, as was heretofore found. The transformer is hermetically imbedded in a box with paraffine. The hanging wire of the antenna can be reeled up in 15 seconds. A safety device can cut off the wire should the aeroplane descend very rapidly in case of accident.

Aeronautics

A New Altitude Record.—At the International Aviation Meet held at Vienna, Csakay (the assumed name of Lieut. Miller) reached an altitude of 13,779 feet on June 29th with a passenger. The best previous altitude record with a passenger is that of Prevost at Courcy, 8,858 feet.

A Wright Memorial Prize.—As a memorial to the late Wilbur Wright the Royal Aeronautical Society is soliciting subscriptions for an annual money prize to be awarded for the best lecture on aeronautics. The lectures will be known as the Wilbur Wright Memorial Addresses.

A Nine-hour Zeppelin Trip.—On June 27th the Zeppelin dirigible "Victoria Luise" made a nine-hour trip with twelve passengers directly out from Hamburg over the North Sea. Starting at 6.15 o'clock in the morning, the vessel passed over Helgoland at 9.15. She landed at Hamburg again at 3.15.

The War Department and Aeroplanes.—It is not probable that any advertisements for the purchase of army aeroplanes will be issued in the near future. The policy of the War Department has been to purchase aeroplanes only from American manufacturers whose products are known to be suitable for military service. Orders have already been placed which will obligate all of the available appropriation remaining on hand and no further purchases can be made until the next army appropriation has been passed and approved.

An Accident Due to Air Wash.—During the first aeroplane meeting held at Rheims, in 1909, aviators for the first time realized the dangers of flying in the wake of an aeroplane. Although the perils that lurk in the wash of a flying machine are fully appreciated, nevertheless a serious accident occurred at Villa Coublay, near Paris, on July 5th last. Lieuts. Briez and Burlez of the French Army started on a flight to Belfort, each in a monoplane. Lieut. Burlez had attained an altitude of about 600 feet, passing the other man at greater speed, 100 feet higher, forcing a current of air downward and causing the machine driven by Briez to lose its equilibrium. The monoplane crashed to the ground and Briez suffered two broken legs, a fractured jaw and injuries to his chest. He is expected to recover.

The Dirigible in Warfare.—The *Slampa* of Turin, says the *Times* correspondent of Rome, publishes a dispatch from its special correspondent at Bengazi, Count Savorgnan di Brazza, which furnishes an interesting description of the work of a dirigible in actual warfare: The "P1" left its hangar at 6 in the morning carrying on board the Commandante Peuco and the pilots, Capt. Saymandi and Lieut. Benigai. The object was to carry out an offensive reconnaissance, for which purpose the dirigible was supplied with bombs. Rising over the sea to the height of 1,000 meters, it turned eastward toward Koefia, and, passing over that oasis, was able to ascertain that, for the moment, it contained none of the enemy. Making a wide detour, the "P1" turned toward the south in the direction of Sidi Mufta, in the neighborhood of which, both at the foot of the Djebel and on the plain, the principal tents of the Turk and Arab camp lie scattered over a considerable space of ground. No sooner had the edge of the encampment been reached than a number of little puffs of white smoke were observed on the ground beneath, and the unmistakable crackle of rifle fire made itself heard in spite of the noisy roar of the airship's motor. The Turks and Arabs had begun a violent fusillade against the dirigible, which promptly answered by dropping its first bomb. A flash of fire and a dense cloud of smoke rose well in the middle of a group of tents, from which men could be seen hurriedly escaping. A second bomb followed the first, producing the same effect. The Turks, realizing the futility of their rifle fire, brought their artillery into action. From the edge of the sand-dunes two flashes were suddenly seen, followed by others. Evidently the artillery had been prepared beforehand for this purpose, for the shells, instead of bursting low, after following the usual horizontal parabola, took an almost vertical line of flight. Ordinary field guns are not suited to such a use, as they cannot be given the necessary inclination; the Turks had, therefore, posted their guns on the actual slope of the sand hills, burying the tail of the carriage deep in the sand to prevent the overturn of the gun owing to the recoil. This position, while it rendered a nearly vertical fire possible, made the laying of the gun very difficult. In fact, in spite of all the preparations made in advance, the aim of the gunners was wild and their fire quite innocuous. The dirigible, on the other hand, let fall other bombs, which seemed to be as effective as the first. The aeronauts, moreover, while carrying on this aerial combat, which lasted almost an hour, were able to accomplish in the most complete fashion possible the chief end of their voyage—that is to say, an exact reconnaissance of the position of the enemy's camp and estimation of the number of Turks and Arabs that had gathered in front of our lines.

"A Shadow in Court"—The Sequel

By William F. Rigge, S. J.

ON February 4th of last year there appeared in this journal an article under the caption "A Shadow in Court." It instanced a case in which the liberty of an accused man hung upon the accuracy with which an astronomer could determine from the position of a shadow the exact time at which a photograph had been taken. As the account was written immediately after the first trial, the subsequent history of the case is not without interest. A brief recapitulation of the facts will obviate the necessity of referring to the original number. E was arraigned on the charge of having placed with malicious intent a suitcase containing dynamite upon D's porch between 2 and 3 o'clock on the afternoon of Sunday, May 22, 1910. The State produced only two witnesses, girls about 16 years of age, who stated that while walking in the neighborhood shortly before three o'clock, they saw a man answering E's description carrying such a suitcase. The attorney for the defense found upon investigation that the girls at the time were coming from a church a mile away. They had attended services there, and had posed for their photographs twice in front of the building. A prominent shadow in one of the pictures gave the attorney the idea of consulting an astronomer in the hope of finding from the position of this shadow the time at which the exposure had been made. The astronomer testified that the time was within one minute of twenty-one and a half minutes after three o'clock. In that case the girls could not possibly have seen the accused at the place and time they averred. This testimony served to split the jury.

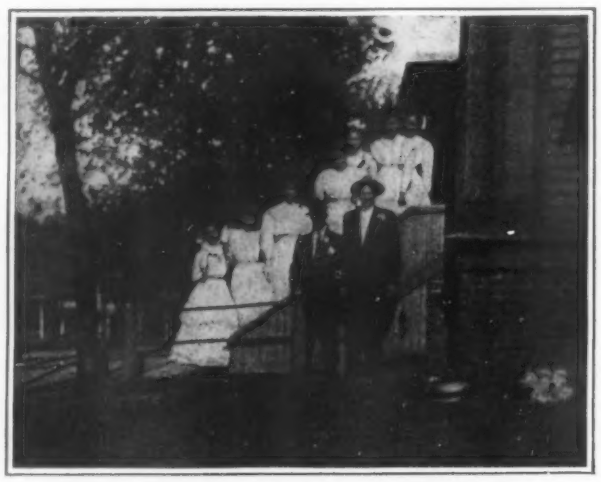
At the second trial substantially the same testimony was advanced as at the first. The attorney for the prosecution, an expert criminal lawyer, realized that his only hope of success lay in invalidating the evidence advanced in the name of science. For this purpose he belittled the calculations and predictions of scientific men generally, and by his sarcasm and witticisms kept the jury in continuous laughter. The unanimous verdict of "Guilty" drew a sentence of fifteen years in the penitentiary.

The defense then appealed to the Supreme Court of the State. While the sifting of the evidence was in progress, the first anniversary of the taking of the photograph occurred, and it gave the expert an opportunity of verifying his findings. The time he had assigned was in error only a quarter of a minute.

Some months later the Supreme Court decided that the accused had been convicted upon insufficient evidence. In preparing for a third trial the prosecution called upon G. D. Swezey, professor of astronomy at the University of Nebraska, to remeasure the position of the shadow and recompute the time. Prof. Swezey, narrating the event at a public meeting of the Nebraska Academy of Science, held in Lincoln, on May 3d last, said that he studiously refrained from consulting or even referring to any of the former measurements or findings until he had completed his own calculations. The outcome was that he obtained a difference of only twenty-nine seconds, thus falling decidedly within the one minute that the defense had allowed as a probable error. The State then abandoned the prosecution.

On May 22d last, the second anniversary, the shadow was again on the same spot it covered at the instant the original photograph was taken. It will be there each anniversary as long as the building stands and the point that cast the shadow, as well as the wall upon which it fell, remain in their original position.

Note that in the first and third pictures the left corner of the shadow is exactly in the middle of a weather board, and that it is below that spot in the second picture and as much above it in the fourth. The computed time, therefore, was certainly correct to the minute, and probably so even within a few seconds.



The liberty of an accused man hung upon the shadow at the right.

An astronomer testified that the picture was taken on May 22d at 3:21½

One minute before the computed time.

One minute after the computed time.

Photograph taken at 3:21½, May 22d, 1912, vindicating the astronomer.

Resuscitation from Electrical Shock

By T. Commerford Martin

OF late years, the increased knowledge of electrical phenomena and the riper experience in handling electrical energy, have done much to lessen the number of fatal accidents from electrical shock. On the other hand, the extended introduction of electricity into the arts and industries, the establishment of numerous circuits of high voltage for transmission and distribution purposes, and in general the preference given to the alternating current for a wide variety of work on account of its flexible use over large areas, have brought a much higher degree of risk than obtained under the old regime of direct current of relatively low potential. The net result has been an apparent swelling of the death roll to an abnormal extent, although in proportion to the universalized employment of electricity, the percentage of shock and fatality has doubtless fallen considerably. There are no exact statistics available on this important subject, but in view of the part that electricity plays in modern life, such data might well be increased in some of the inquiries of the United States Bureau of the Census. In 1895, when the present writer was one of its editors, the *Electrical World*, impressed with the necessity for popular instruction on the subject, issued in broad sheet form a chart of instructions to be followed in cases of apparent death from electrical shock; and a revised version of these rules was issued by the same journal in 1902. Without question, the use of these rules for securing resuscitation was successful in a great many instances; and the demand for the charts, circulated gratuitously, became so great, no one can now say how many thousands were printed. They are to this day a prominent feature on the walls of electric power plants throughout the world. It happened, however, that this chart was based on the Sylvester method, directing that the victim of the shock should be laid *on his back*, and his chest expanded and compressed by drawing his arms forward and then pushing them back against his ribs. Serious doubt arose in the course of time as to the real virtue of this method, and meanwhile the Schäfer method attracted attention as probably superior in effectiveness. It consists simply in laying the victim *on his belly*, and then applying pressure rythmically on his loins and lowest ribs. This is known as the "prone pressure" method, and it was soon taken up in Europe, although both there and here the Sylvester method persisted. A crisis was reached about three years ago, the older charts were no longer given out, and it was felt that something must be done to secure unanimity; in doing which the percentage of cases of resuscitation would obviously be raised. When the matter, or the situation, came to the notice of the National Electric Light Association, with its 1,500 private corporations engaged in public service in the United States, to the tune of 100,000 employees, $2,500,000,000 investment and 1,000,000 or more customers, it took the problem up with commendable activity, and at once organized the forces of safety. Two years ago it called into conference the leading engineering societies of the country, the United States Army and Navy, the United States Bureau of Standards, the American Museum of Safety, and the American Medical Association; and the authoritative dealing with the problem was relegated by unanimous vote to the last named powerful organization, the National Electric Light Association and the American Institute of Electrical Engineers. These three bodies selected their representatives as members of a commission, its expenses to be borne entirely by the National Electric Light Association, and then the work was taken seriously in hand. The members are as follows: Dr. W. B. Cannon, chairman, Professor of Physiology, Harvard University; Dr. George W. Crile, Professor of Surgery, Western Reserve University; Dr. Yandell Henderson, Professor of Physiology, Yale University; and Dr. S. J. Meltzer, head of the Department of Physiology and Pharmacology in the Rockefeller Institute of Medical Research—the four from the American Medical Association. Dr. E. A. Spitzka, Director and Professor of General Anatomy, Daniel Baugh Institute of Anatomy, Jefferson Medical College, and Mr. C. L. Eglin, Past-president of the National Electric Light Association—named as representatives of the National Electric Light Association. Dr. A. E. Kennelly, Professor of Electrical Engineering, Harvard University, and Dr. Elihu Thomson, Electrician, General Electric Company—nominated by the American Institute of Electrical Engineers. Mr. W. D. Weaver was elected secretary by the other members of the commission. It is quite needless to point out the distinction and capacity of this able body of men.

Three problems confronted the commission, and in reality only one of them has been disposed of thus far, in the issuance of the new rules, which are based wholly on the Schäfer prone method, approved because of its superior simplicity in application, easy performance by laymen, slight risk of injury to the subject, large ventilation of the lungs, and absence of trouble from the falling of the tongue back into the air passage. The new rules have been issued, both in broad sheet and in vest pocket form, with illustrations of the method. These are copyrighted by the National Electric Light Association to secure integrity of the rules, and are issued at cost, but on request anyone can secure permission, without charge, to reprint in any form, as the commission desires to give the rules the widest vogue and publicity. These documents were formally presented at the National Electric Light Association convention at

(*Concluded on page 65.*)

The Wirelessly Directed Torpedo

Some New Experiments in an Old Field

By Benjamin F. Missner

IN the year 1897, when wireless telegraphy was in its infancy, Ernest Wilson, an English scientist, was granted a patent on a system for the wireless control of dirigible self-propelled vessels. The primary object of the invention was to provide a weapon for use in naval warfare, which, if in the form of a dirigible torpedo controlled from a shore or ship wireless installation, would be most deadly in its effect on a hostile fleet. Wilson's was the pioneer patent in that branch of radio-telegraphy now commonly called radio-telautomatics. Since then a large number of patents on telautomatics have been taken out by various inventors, and several of those who have been so fortunate as to possess the means, have developed their respective systems in the effort to realize their possibilities.

Gardner of England, Wirth of Germany, Gabet of France, Roberts of Australia, and Tesla, Sims and Edison of the United States during the last ten years have attempted to solve the problem in a practical way. Gardner, Wirth, Gabet and Tesla have used their systems on boats intended primarily for torpedoes, which they control by Hertzian waves. Sims and Edison, with the co-operation of the United States Government, developed a system for controlling a dirigible torpedo through a trailing conductor, and Roberts has applied his system to dirigible balloons. These inventors have had various degrees of success in their endeavor to perfect their inventions, but apparently none has reached the goal. It is true they have controlled the movements of vessels without the aid of wires, but at the best the apparatus worked spasmodically, unsatisfactorily, and the greatest distance at which their vessels were controlled has not exceeded a half mile. But why, we may ask, have these learned men failed to secure the desired results when wireless telegraphy, the mother of radio-telautomatics, has made such wonderful progress?

By analyzing the situation we may find that early in the art potential-operated receiving devices, such as the coherer, which was developed from Branly's tube, were used which permitted the use of recording mechanisms. As the art progressed new receptive devices were discovered which when used with the most sensitive of all electrical instruments, the telephone, proved the coherer comparatively insensitive and unreliable. Coherers and relays were discarded and replaced by the detectors and telephones, which provided a means of signaling over vastly greater distances with the same amount of transmitting power. The new detectors while forming a very desirable combination with the telephone, were entirely unsuitable for use with relays, and, therefore, those men interested in the control of mechanisms were compelled to retain the coherer as the receiving detector. This is the reason for the poor success attained in the field of radio-telautomatics. The coherer, being spasmodic ("somewhat feminine") in its action, sometimes operates when the transmitting key is pressed, and sometimes operates when no signals are sent, probably steering the boat to starboard when the signal should have sent her to port, or stopping the engine when full speed was desired.

House-boat used to demonstrate the Hammond system of torpedo control.

The coherer has, therefore, been the barrier to the realization of the invention's possibilities.

During the summer of 1911, J. H. Hammond, Jr., a young inventor of Gloucester, Mass., carried on experiments on the control of a dirigible boat, with a considerable degree of success. With no great amount of transmitting power (1.5 kilowatt) and comparatively

John Gardner and his dirigible boat.

poor antennae (80 feet and 30 feet, respectively), Mr. Hammond was able to keep the boat under perfect control at distances up to and over a mile.

The boat, which has a displacement of over eight tons and a speed of about five miles per hour, was steered over a prearranged course during both day and night in all conditions of sea and weather. The course was by no means simple, following as it did circles around buoys and a complete circle around the harbor. Fishing and other vessels were continually moving about the harbor, but no great trouble was experienced in avoiding them and at the same time keeping on the prearranged course. It was found possible to steer the boat directly against either of several upright spar buoys a mile from the transmitting station. At night, lights, automatically controlled by the steering mechanisms, kept the "helmsman" at the transmitting key informed of the boat's action. The steering of the boat was accomplished by sending Hertzian wave impulses, which, affecting suitable receiving apparatus and switching devices, controlled an electric motor mechanically connected with the steering wheel. The rudder could, therefore, be made to move to port or starboard, or could be set at any intermediate position at will from the transmitting station.

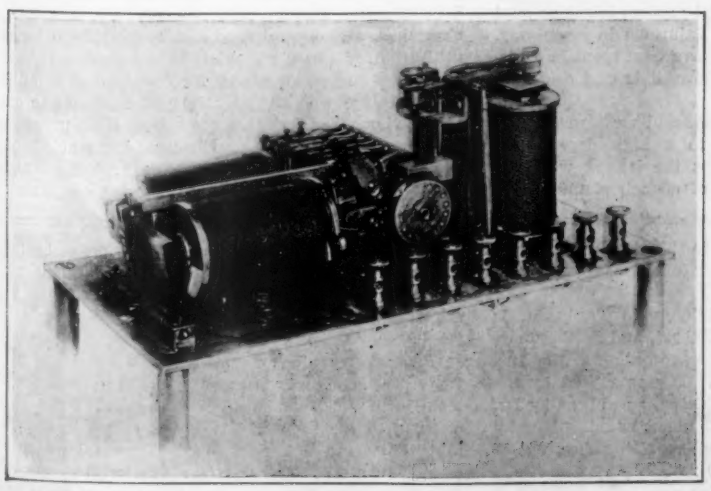
The success of Mr. Hammond's experiments is due largely to the fact that he early realized the unsuitability of the filings coherer, and adopted a more sensitive and reliable type of detector, namely, the mercury-steel disk coherer, which was invented by Sir Oliver Lodge and Dr. Muirhead, and used in their system of syntonic wireless telegraphy. While not entirely satisfactory, the Lodge-Muirhead coherer proved a great advance over the filings coherer, and no difficulty was experienced in operating the sensitive relay used with it at distances up to two miles.

Mr. Hammond, encouraged by last year's work, is building and equipping a large station at Gloucester for further experiments in telautomatics, and with non-interferable systems. Two towers 340 feet high for supporting the aerial wires are being constructed, and eight complete transmitting and five complete receiving sets will be available for use in experimental radio-telegraphy and telephony.

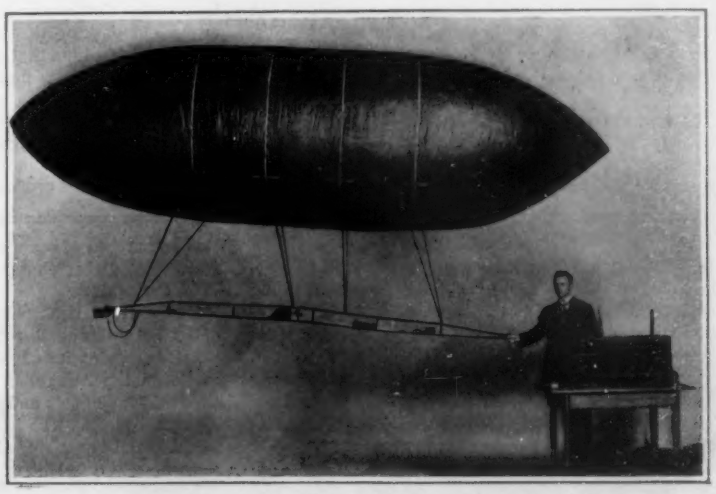
An entirely new receiving detector and a sensitive relay have been developed during the past winter which will greatly increase the range of operation. These instruments, being electrically and mechanically stable, will require no adjustment.

In addition to the wireless equipment, a boat of special design is being built, which will travel at a rate of thirty miles per hour. This boat will be equipped with the wireless control apparatus and will be operated from the station. A 24-inch searchlight and selenium cells of extreme sensitiveness will also be used in controlling the boat, by sending light wave impulses, the wave length of which is of the order of 1/44,000 of an inch in length, instead of or in conjunction with impulses of electro-magnetic waves whose length is of the order of 3,000 feet.

Considering the amount of work that is being done along the lines of torpedo control in the United States and in Europe, and the progress that is being made in radio-telautomatics, it is very probable that the dirigible torpedo will, within a few years, occupy a prominent place as a deadly weapon in naval warfare. It would be absolutely invisible except in the very rare case of an absolutely calm sea.



Hammond's apparatus used in wireless control of the boat.



A. J. Roberts and the balloon which he controls by wireless.

The Business Side of German Science—VIII

Making Money With the Aid of Technically Trained Men

By Waldemar Kaempffert

(Concluded from page 26, July 13th, 1912)

[*THIS is the eighth of a series of articles, written by the Managing Editor of the* SCIENTIFIC AMERICAN, *on German industrial conditions. The author was sent abroad by the publishers for the express purpose of gathering the material on which the articles are based. In this and the article to follow, the part played by the technically trained man in German business is pictured.*

The amazing industrial development of modern Germany is to be attributed in large part to technical education and to the application of science to business. Capital and science work hand in hand. Every one of the great chemical discoveries of our times, most of them made in Germany, are the result not of haphazard experimenting, but of systematic research that has meant the expenditure of princely sums. All German manufacturing is so thoroughly saturated with science, that even the small producer practises on a miniature scale the methods of his larger rivals.]

The Story of Indigo.

The pertinacity with which a German chemical company will carry on investigations for years, fully convinced that ultimately the goal will be reached, finds no more brilliant example than the development of a commercial process for the manufacture of artificial indigo. In the eighties Prof. von Baeyer of Munich succeeded in producing synthetic indigo—a great achievement. Two of the most powerful chemical firms of the day took up the invention almost immediately. They set chemists and engineers at work. After much time, money, labor and thought had been spent in endeavoring to base an industry on von Baeyer's discovery, it was found impossible to produce indigo in commercial quantities by the means that he had indicated. The firms who backed the invention were discouraged perhaps, but not beaten. When Heumann discovered a method of obtaining synthetic indigo from the phenylglycins, a commercial future for artificial indigo seemed to have dawned. Heumann was practically taken into partnership with capitalists who recognized the immense possibilities that lay in his discovery. Without them he would have been able to do nothing. Seven years of hard work elapsed before the first indigo could be manufactured by Heumann's process for the market.

It pays to spend money and time so lavishly. The amount of indigo manufactured to-day would require the cultivation on an area of more than one-quarter of a million of acres of land in the home of the indigo plant. As late as 1897 thirteen million pounds of indigo were grown, valued at twenty million dollars. Not more than one-sixth of this quantity of natural indigo is now marketed. The Calcutta harvest for example, in 1896 amounted to 158,922 maunds and in 1909 to only 31,200 maunds, a maund being 82.14 pounds. In Java, in 1898, there were 122 indigo plantations; in a few years they were reduced to 28. A harvest which in Java amounted to 12,580 boxes in 1898 was reduced to 2,015 in 1908. In 1897 Germany imported $3,200,000 worth of natural indigo; in 1909 only $160,000 worth. On the other hand the export of synthetic indigo in Germany amounted to nearly $2,000,000.

The same story is repeated in the history of alizarin. In 1868 France exported about $600,000 worth of madder. To-day madder is almost unused. Instead, millions of pounds of artificial alizarin are manufactured, seven-eighths of the entire output in Germany. In 1892, 320,000 pounds of cochineal were used in Germany. In 1897 the use of cochineal had dropped to about 34,000 pounds.

Reducing the Cost of Old Processes.

The men in the research laboratories of German manufacturing companies are concerned not only with the discovery of new compounds and the inventing of new apparatus, but also with the simplification and the cheapening of old and long established processes. There has been a vast improvement, for example, in the manufacture of salicylic acid, of which one hundred and twenty-nine tons were exported from the German Empire in 1882, and five hundred and two tons in 1905. Although in twenty years the amount exported increased four times, the price of the acid dropped to one-sixth of what it was originally. In 1900, again, anti-febrin was worth about seven and one-half times what it brought in 1905. Vanillin, which has taken the place of vanilla extract, and which has been produced artificially for the last thirty years, was worth about $1,800 a pound in 1876; in 1902 it was worth about $8 a pound. These remarkable reductions in the selling price are to be attributed entirely to simplified methods of manufacture. The result of the cheapening has been the opening of a much larger market than could otherwise be supplied.

In the dyestuff industry the advances which have been made in the last decade in thus improving original processes is perhaps more marked than in any other phase of German manufacturing. Most of the improvements have resulted in securing a greater degree of fastness to washing, light and similar agencies. Thus, in dyeing cotton the want of fastness of the earlier "salt" dyestuffs soon led to attempts to fix the colors after dyeing. One result of these many attempts was the introduction in 1894 of Vidal black. Immediately a wonderful development of "sulphide" dyestuffs followed. The cotton dyer obtained cheap dyes of much greater fastness than those of the old "salt" class, which, therefore, were gradually displaced. Sooner or later the sulphide dyestuffs will have to give way to the newer vat dyes of the anthracene and indigoid classes when they have been cheapened sufficiently.

Sometimes the discovery of a new process may lead a rival manufacturer to begin a systematic study of an old process in order to improve and cheapen it to such an extent that it will not be crowded out of existence. An example is to be found in the making of sulphuric acid. When the Badische Company devised a method of making sulphuric acid commercially by the contact process it seemed as if the old lead-chamber was doomed. But the story of the competition between the electric light and the gas light was repeated; a method was found of improving the old lead-chamber process and increasing its efficiency, so that it is still worked side by side with the contact process.

Testing New Products Before Marketing Them.

The introduction of a new dye, a new drug, a new explosive, and new fabric is not conducted in a haphazard way. Business men the world over realize that there is an ethical side to the selling of goods. The old days when a salesman was simply a hired liar who stopped at nothing in selling his goods are over. A modern manufacturer not only refuses to misrepresent his products, but he will not even market them if they are not at least as good as the old.

In connection with every research department in Germany will be found a testing laboratory—a place where a newly discovered product must prove its worth. A new dyestuff is subjected to hundreds of practical tests before the public ever hears of it. It is tested for fastness by exposing it to the sunlight by ascertaining how it withstands ordinary alkalis and much washing, and by noting its effect on leather, paper and fabrics in general. As a result of hundreds of tests it may be revealed that a new chemical product is not as good as an old one, or that it is injurious in some way. Despite the fortune that may have been spent in devising a process for its manufacture, it is cast aside immediately.

The introduction of new drugs and medicaments imposes this moral obligation to a high degree. At Hoechst will be found perhaps the largest works in the world for the production of medicines and chemicals that are used in the ordinary physician's practice. Here will be found remarkable laboratories for testing the qualifications of a new virus, serum, drug, or narcotic which is to be used in curing human ills. The laboratory physician works hand in hand with the chemist; the physiologist with the physicist. No bacteriological laboratory, no hospital is conducted with more scrupulous care. A fine stud of thoroughbred horses, from three to eight years old, are an indispensable aid in supplying sera and anti-toxins. The therapeutic agents discovered are rigidly controlled partly in the Institute for Experimental Therapeutics of Frankfurt, partly at Hoechst itself. Diphtheria serum, anti-dysentery serum, anti-pneumococci serum, anti-streptococci serum, scarlet streptococci serum, tetanus serum, Robert Koch's tuberculin preparation, as well as Ehrlich's salvarsan are here prepared and carefully tested before they are sent out.

Analysis of Raw Material.

No longer is raw material bought simply by quantity and with only the most superficial regard for quality. Mass production is the reason. When the output of a steel mill or a sugar factory is millions of tons a year, it pays to save a cent a ton on raw material; it pays to determine beforehand and exactly how much of the raw material can be utilized to produce a certain amount of goods. The old-fashioned miller for example used to thrust his hands into the grain that he bought in order to feel its moisture; or he would grind it between his teeth. It is perfectly obvious that by such crude methods he could not determine differences in moisture of one or two per cent; yet such extremely slight differences may be of untold importance in modern milling. Grain is sold by weight. If it contains a large percentage of water, the miller is simply buying moisture which easily evaporates. Hence, we find that the modern miller—and particularly the modern German miller—scientifically analyzes the grain that is offered to him. Not only does that analysis govern the price to be paid for the grain, but it determines its keeping qualities. When grain is to be stored for a long time, it is not a matter of indifference whether it contains fourteen per cent or sixteen per cent of water. Experience has shown that wheat containing as much as fifteen per cent will keep for a long time, whereas wheat containing only sixteen per cent—only one per cent more—may suffer.

Only a very wealthy firm, it may be argued, can afford to pay a scientifically trained man to test raw materials in this way. That is true enough. But the small firm in Germany proceeds scientifically nevertheless. Much valuable technical assistance is given by manufacturing firms to small consumers of their products who are not able to engage a chemist or a technically trained man regularly. Thus the firm of Simon, Bühler und Baumann of Frankfurt employs a chemist whose chief duty it is to assist breweries and millers to reduce their cost of manufacture by analyzing raw material and waste products, and submitting the results of his examination. Moreover, there are dozens of consulting technologists whose services may be engaged for no very large sum.

The Sociological Side of German Industry.

There is a sociological aspect to German industrial science which is obscured by a national prosperity expressed in exports that amount to millions and millions of marks a year. Each new coal tar drug that is unearthed, each new method that is discovered for the utilization of waste material, means work. It is no small task to provide places for one-third of a million human beings who annually demand a chance to earn their living. The fact that there is so little poverty in Germany, that a task is provided for every able-bodied man, is due in large measure to the laboratory scientists in the employ of the huge manufacturing companies.

Macquarie Island

PUBLIC attention has recently been directed to Macquarie Island, owing to the fact that the Mawson Antarctic expedition, on its way south, established a wireless telegraph station here, so that the island is now in daily communication with Hobart, Tasmania. It was hoped that this station would be able to relay messages to a wireless station at Adelie Land, the base of the expedition on the Antarctic continent, but this plan has proved impracticable. It is said that magnetic disturbances due to the proximity of the south magnetic pole make communication between these two points impossible. However, the Macquarie Island station has proved of some value to shipping in Australian waters by giving timely notice of storms coming up from the south.

Macquarie Island, which belongs to Tasmania, is about 750 miles southeast of Hobart, and is, therefore, a halfway point for expeditions proceeding to the Antarctic on the Australian side. It was visited by the expeditions of Scott and Shackleton, as well as by Dr. Mawson's party. The island is about 22 miles long by 5 broad, and has a rugged coastline, rising sheer out of the water to a height of 1,500 feet in places.

According to a recent consular report this island has been leased by the Tasmanian government to Mr. Joseph Hatch, who has established here the lucrative business of catching penguins for their oil; probably the most southerly industry of the world, except certain fisheries. It is said that there are 80,000,000 penguins on the island. The oil is obtained by boiling the carcasses in digesters capable of dealing with 800 birds at a time. The product is barreled and sold to binder-twine makers in Australia and New Zealand. The chief obstacle to the success of this enterprise is the fact that the island has no harbor. Vessels have to lie about half a mile offshore, and all material is conveyed to and fro on rafts made of casks. Several ships have been wrecked in attempting to visit the island.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Stress in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

Apropos of your recent editorial on the stress in aeroplanes, I note that the values in my table in the SCIENTIFIC AMERICAN of August 26th, 1911, have to be multiplied by 22/15 to make them correct. The abstract formula used in computing those values is right, but by an oversight the factor 22/15 was omitted from the arithmetical computation. All the more, therefore, the warning in your editorial appears to be well founded. A. F. ZAHM.

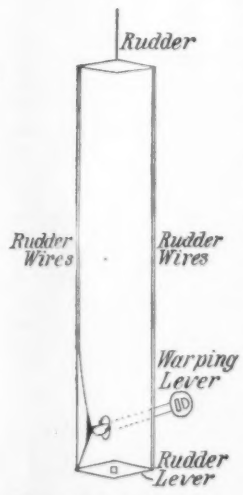
Cosmos Club, Washington, D. C.

An Explanation of the Quimby Accident

To the Editor of the SCIENTIFIC AMERICAN:

As manager of the aviation meeting at which Mr. Willard and Miss Quimby came to a violent end, I had unusual facilities for making prompt examination of the wreckage and I wish to make the following report in the hope that all monoplane constructors will avoid such a defect in construction as existed in Miss Quimby's Blériot monoplane.

Referring to the rough sketch which I inclose, which is a plan view of the machine upside down as it rested in the water, I found that one of the two left-hand control wires (all of the Blériot control wires are in duplicate) had caught over the lower end of the warping lever. Of course this is a defect in construction as the rudder wires should either have been put farther away from this warping lever, or else been run through guides at this point so as to prevent them becoming entangled with it.



Plan view—upside down.

The reason this has not happened before in a Blériot monoplane is because the warping lever, as used in Miss Quimby's machine, was not the conventional Bleriot "cloche" which was a feature of my 70 horse-power monoplane, and all others I have ever seen. I noticed this departure from conventional Blériot practise when I examined Miss Quimby's machine before the flight. I have also called the matter to Monsieur Blériot's attention in a letter under this date.

It is some satisfaction to know definitely the cause of this accident and I assure you that I hardly think there is a chance of my being mistaken. I was the first one to examine the wreck and this rudder wire was caught over the control lever when I looked at the machine. And from what happened in the air, for I saw the whole accident, I am convinced that this was the difficulty. At any rate, the construction should not have been such that this wire could possibly have been looped over the control lever whether in the air or at any other time. It is too bad that all aeroplane accidents do not leave such a clear record of their cause. EARLE L. OVINGTON.

Newton Highlands, Mass.

[We have had an interview with Miss Quimby's mechanic, and the following is his version of the accident:

Miss Quimby had returned from her flight to the Boston Light and had made one big circle over the field, at a speed of 70 to 80 miles an hour. She was flying without banking the machine, which was unnecessary on account of the size of the circle she was describing. At the beginning of the second round the mechanic saw Mr. Willard fall out. Relieved of his weight, the machine instantly dived at an angle of about 60 degrees. Miss Quimby succeeded in partially righting it before she, too, was flung out. The machine glided down at an angle of not more than 30 degrees, struck the water, and turned over. The mechanic examined the wreck of the machine almost immediately, and found everything intact about the controls. He states that there was no fouling of the rudder wires by the control post, that, indeed, this was an impossibility because there was a clearance of at least four inches between the end of the post and the rudder wires when the post was moved as far as possible to the right or to the left. It is difficult to reconcile the mechanic's explanation with that of Mr. Ovington. Hence, we publish both accounts, regretting that the true cause of the accident will probably never be known. The mechanic's explanation of how the accident happened starts with the loss of the passenger, who, he believes, may have become ill and have stood up in an endeavor to signal to Miss Quimby to descend. It is possible that the machine was skidding sideways slightly and that Willard fell over the side. The mechanic did not see just how he fell, but saw everything that happened afterward. Miss Quimby's arms were broken and her chest crushed in, evidently from her being thrown forward with great violence on the curved hood when the machine made a sudden dive. Consequently, she could not right the machine, even if it were possible when once the passenger was gone. Miss Quimby had never experienced any difficulty in controlling her powerful Blériot. That she could manage it perfectly was shown by the fact that she alighted and started on a strip of ground only 100 feet wide during her flights at Boston. From all this it would appear that the machine had a fatal defect in becoming unbalanced as soon as the passenger was thrown out. Without a passenger or pilot, however, it seems to have been perfectly balanced and to have glided safely to earth.—EDITOR.]

Mississippi River Levees

To the Editor of the SCIENTIFIC AMERICAN:

The levees or dikes of the Mississippi River continue giving way, thus proving by practical demonstration the futility of the earthen dike system now in vogue along its banks for protection against overflow. The Government as well as individuals has sustained irreparable loss this season from the innumerable crevasses caused by the record-breaking flood height. It would be a conservative estimate to place the value of the standing levees along the Mississippi at $50,000,000. This is for levees now standing that have successfully weathered this season's flood, it would not include millions of dollars spent in years gone by for levees washed away, fallen in, etc.

There is now a strong movement on foot by the different States, petitioning Congress to take over to Government care the building and maintenance of these dikes. No doubt Congress will do the right thing particularly as it is in line with the administration policy.

By way of economy to conserve the fifty million dollars of dikes now standing, it would not be a bad idea to sheet pile directly through the center of the crown. Tongue and groove piling such as "Sewall" or "Wakefield" would answer admirably, particularly if the timber was creosoted, thus insuring an unlimited life; this would present a powerful barrier and be absolute proof against the ravages of musk-rats, cray-fish and king-fishers. The piles should extend from the top of the levee down into the original ground fully 10 feet. In localities where cypress timber is obtainable, the piles could be made of that wood which would last indefinitely underground, without treatment, and be a saving of nearly 50 per cent over creosoted timber. This work, using cypress, ought not to cost more than $5 per foot, in place.

New Orleans, La. C. JULIAN BARTLETT, C. E.

Successive Passages of the Sun Through the Equinox

To the Editor of the SCIENTIFIC AMERICAN:

To the inquiry of Mr. John Ford, appearing in your issue of May 25th, I have to say that in the issue of March 2nd, the interval between successive passages of the sun through the equinox (365 days, 5 hours, 48 minutes, and 46 seconds, according to Mr. Fox) is given as 365 days, 5 hours, and 49 minutes, and that my figuring was done accordingly, but I failed to take into consideration that a leap year is added every 400 years. Further, in figuring out the editor's answer, I discovered that my statement, "at the end of each century we are still short 344 minutes," should have been 384 *minutes* (1,440 less 1,056) an error which was probably overlooked both by the editor and Mr. Ford.

After going over Mr. Ford's figures I find them correct, and thank him for having called my attention to the subject. WILLIAM FALBE.

Mayaguez, Porto Rico.

A Card Trick

To the Editor of the SCIENTIFIC AMERICAN:

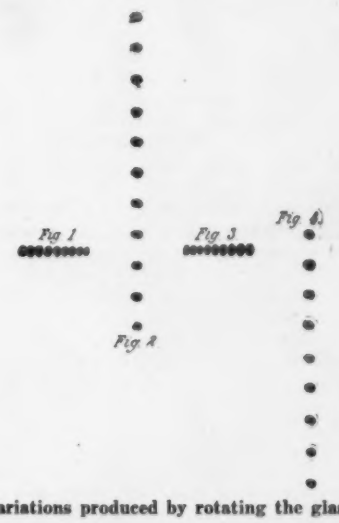
The following card trick was explained to me during a recent railroad journey, and I was told that so far as the party knew, it had not been published. It is called the "Hawaiian Islands," and the little story was told as the cards were laid out in playing the trick. The story ran something like this:

There were four islands in the sea (and the four aces were laid out for the islands) and on these islands there were diamonds (four diamonds being placed one on each ace) and four kings went to get the diamonds on these islands (putting the four kings on the four diamonds) and these kings had nothing to dig with but spades (four spades being laid out, one on each pile) and four pirates went to rob the kings of the diamonds (the four jacks being laid out on the piles) and these pirates had no weapons but clubs (four clubs being placed out on the piles) and four queens went to save their kings from the pirates (the four queens being placed one on each pile) and these four queens had nothing to take with them but their hearts (four hearts being laid one on each pile). When the cards are so laid out we have four piles beginning with an ace below and including each an ace, a diamond, a king, a spade, a jack, a club, a queen, and a heart. Now place these four piles one upon another into a single pile or pack. This pack may now be cut, by a square cut, no double cuts allowed, and it may be cut as many times as desired by the party to whom the trick is being exhibited. Then after the party has cut as many times as desired, take the pack and put the cards out in eight piles, taking them in order and going back to the first pile from the end of the eight in regular order through the eight piles, and it will be found that all four aces will be in one of the eight piles, all four kings in another, all four queens in another, and so on throughout the series of eight. It may add to the interest of the trick for the party playing it to insist on the right of making at least two cuts after the other party has cut to his heart's desire. The trick is absolutely certain in its results when properly played, and it makes no difference whether the party cuts once or a thousand times, if the cut is always a square cut. He may cut deep or shallow as he pleases, and the result is not changed. REGULAR READER.

Where Do the Secondary Images Come From?

To the Editor of the SCIENTIFIC AMERICAN:

I have observed that when light from a bright source, for example, an electric light, falls on a plate glass mirror at a very large angle of incidence—as near as possible to 90 degrees—a number of images become visible in the mirror. At first I supposed this was due to multiple



Variations produced by rotating the glass.

reflection from the two faces of the glass, but I have difficulty in accounting for the different positions of the images. If the glass is kept in the same position but rotated about an axis perpendicular to the plane of the mirror, the brightest image, which is the second one in the series if a silvered mirror is used, seems to remain in about the same position, but the secondary images move around the bright one.

When the glass is held in one position, the images appear as in Fig. 1. When the glass is rotated through 90 degrees, the images move to the positions shown in Fig. 2. Another 90 degree rotation gives Fig. 3, and so on. In Figs. 2 and 4 the secondary images appear to be about as far from the eye as the primary, but in Figs. 1 and 3 I believe they are unequally distant from the eye, although it was very difficult for me to determine whether the primary or secondary images were the nearer. I thought that perhaps in Fig. 1 the secondary images were nearer and in Fig. 3 they were farther from the eye than the primary, or *vice versa*. If this is true, it would indicate that the secondary images were rotating in a circle or ellipse the plane of which is nearly perpendicular to the plane of the mirror but oblique to the reflected ray along which, of course, the eye is looking.

The light giving the secondary images after the first three or four is plane polarized, as was shown by examining it with a Nicol prism. I suppose this might be accounted for by the several reflections which it has undergone, but why should the secondary images change their location while the mirror merely rotates in its own plane?

It occurred to me that the glass might be double refracting and the secondary images due to the extraordinary ray, but this does not seem very clear to me. If this is the true explanation, the question at once comes up as to what becomes of the ordinary ray. The plane of polarization does not rotate as the secondary images move around the primary.

Emporia, Kans. W. B. LEWIS.

The ruins of Samaria, looking west.

Recent Excavations at Samaria

Discovery of the Palace of Ahab

Herod's Buildings Unearthed and Ancient Jewish Inscriptions Found

By Harold J. Shepstone

Idols from Samaria.

ONE of the most interesting and valuable discoveries so far recorded in the field of Biblical archæology has been the recent unearthing at Samaria, in Northern Palestine, of the palace of a Hebrew king, believed to be the "ivory house" of Ahab. Labels with Hebrew writing, which seem to have been in actual use during the life time and perhaps in the households of Omri and Ahab, have also been found, as well as many fragments of pottery. Many Biblical names appear in the writings, such as Elisha, Asa, Nathan, Uzza, Sheba, and Abiezer.

Samaria was the ancient capital of the Northern Kingdom of Israel. When Solomon died, about 930 B.C., his kingdom broke into its two natural hereditary divisions, Israel and Judah. Shechem, the first capital of Israel, lying in a narrow valley and therefore difficult to defend, was abandoned for Tirzah. This in its turn, about 875, was given up for a new site. Omri, founder of the third dynasty of Israel, chose for his capital an isolated hill some six miles northwest of Shechem. The city which he built here he called Shomeron, now best known by the later Greek form of the name, Samaria.

The hill rises to a height of 400 to 500 feet above the valleys which surround it. From the summit, some 1,400 feet above sea-level, one may see the Mediterranean, on clear days, some twenty miles to the west. There are also fine views into higher mountains on the north and east, and over the hills and valleys south and west. The naturally steep sides of the hill were easily rendered impregnable by massive walls. The Herodian city, occupying the top of the hill, was about two and a quarter miles in circumference, and the city of Omri was perhaps not much smaller. The Herodian wall can still be easily traced. There is no fountain on the hill, and the people of the city must have been dependent on a spring across the valley and on rainwater stored in cisterns, of which a great many have been recently unearthed. The hill and the country around are fertile, producing good crops of olives and figs, grain and onions, and in antiquity, grapes also. For agricultural purposes the hill and those about it have been heavily terraced, a work which has greatly disturbed and confused the ancient débris.

Samaria remained the capital of Israel till taken by the Assyrians in 722. Here Ahab, under Jezebel's influence, built a temple to Baal, later destroyed by Jehu, and here it seems he built also his "ivory house" or palace, described in the First Book of Kings. Then it was in Samaria that Elisha had his home. The city underwent many vicissitudes while under Assyrian and Babylonian rule. It reached its highest artistic glory, however, under Herod the Great, who rebuilt it in great splendor and named it Sebaste or Sebustyeh (Latin, Augusta) in honor of his imperial patron, Augustus. Sebustyeh is still the name of the village on the eastern slope of the hill. Herod fortified the place, and built a great temple here in honor of Augustus.

This, briefly, is the history of the site of the recent excavations which have been most fruitful of result. They were undertaken by the Harvard University. The only condition which the Turkish Government insisted upon was that the place be left just as it was before the excavations. This compelled the explorers to do their digging in sections, the earth from each fresh section uncovered being used to bury again that already laid bare after it was minutely examined and fully and accurately planned. Hence it follows that of the very extensive work of uncovering done, first under the direction of Prof. Lyon of Harvard, and later under that of Dr. Reisner, well known in connection with similar work in Egypt, only comparatively limited portions can now be shown by photographs.

The most extensive and the most interesting work done was that on the summit of the hill. Here sometimes as many as four hundred men, women and boys, including gangs of experienced workers from Egypt, were employed at one time, and here, by long continued and indefatigable toil, the rubbish of successive generations, civilizations and conquests was removed, for a depth of many feet, until the bed rock was reached, which disclosed, almost without a doubt, the extensive palace of Omri and Ahab, covering an area of nearly two acres. The lower courses of the masonry which came in contact with the rock showed the same peculiarity as was discovered when, nearly a generation ago, the wall of the Temple inclosure in Jerusalem was laid bare to its foundations, eighty feet below the present surface. The first course of stone in the temple was embedded in the living rock, in such a way that that layer had rock on all three sides of it, which seems a distinctively Jewish feature. It was at this level in the excavations at Samaria that an alabaster vase, with the Egyptian inscription of their contemporary king, Osorkon II., was found, confirming the assumption that this was the palace of the Jewish kings.

Here it may be noted that this is the first and only palace of a Hebrew king ever found, and accordingly is unique and of the deepest interest to archæologists and Biblical scholars. It was undoubtedly an immense building, consisting of chambers grouped around courts. Here and there stand portions of the finished wall to a height of several courses of stone. Moreover, two grades of construction appear, a coarser and a finer. The explorers suggest that we have here the palace of Omri enlarged in a superior style by his son Ahab.

There were also discovered here some seventy-five fragments of pottery inscribed with records or memoranda in the ancient Hebrew script. This is not the comparatively modern square Hebrew character with which most persons are familiar, but that ancient writing, closely allied to the Phoenician, which is found on the Moabite Stone and the Siloam Tunnel Inscription. The character of these inscriptions has settled one disputed point about that of the Siloam. It shows that it could easily have been written in the time of Hezekiah, as it purports to be, for here is writing of the same type used at Samaria more than a century and a half earlier, for Ahab lived in 896 B. C. and Hezekiah in 727. These inscriptions are written in ink with a reed pen, in a flowing hand, proving that this was the common form of writing at that period. The words are evenly divided from one another by dots or strokes, making it much easier to decipher them. It is evident that the inscriptions were written upon jars of wine and oil, and even a date is added, evidently the year of the king's reign. The owner's name is given, as well as the person or place whence the oil or wine came.

Here are some of the inscriptions, proving how exact the ancient scribes were in their methods:

"In the tenth year. For (or belonging to) Shemaryo. From the Tell. A jar of fine oil.

"In the ninth year. From Shaphtan. For Ba'alzamar. A jar of old wine.

"In the eleventh year. From Shemida. For Heles, Aphsah, Baala (and) Zeker.

"In the tenth year. Wine of the vineyard of the Tell. With a jar of fine oil."

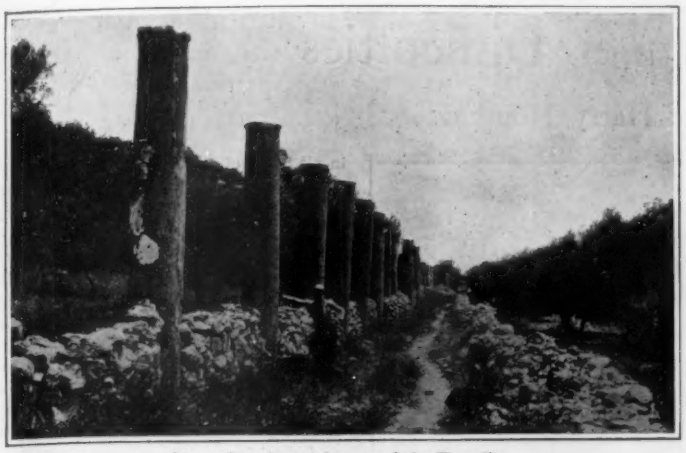
These jars were evidently stored for their owners, but where no owner is mentioned the wine probably belongs to the king's palace. It will be noticed that in some of the inscriptions the "Tell" or "Vineyard of the Tell" is mentioned. It is evident that this vineyard must have been one that was especially well known. No vineyard in all history was so well known as the "Vineyard of Naboth," and it gained its fame in the reign of King Ahab.

The excavations on the summit showed four superimposed eras of structures—Jewish, Babylonian, Greek, and Herodian or Roman—in one case, as it were, preserving within the inclosure of the larger building of later date the core of the older edifices. Of the Roman remains found the most imposing was the 80-foot wide staircase leading down to an altar and probable temple, put up in honor of the Emperor Augustus, where was also found the huge marble trunk of a Roman statue, lying headless and without arms or limbs, which was in all probability that of Cæsar. The crate containing this relic can be seen in one of our photographs at the foot of the great staircase.

Besides the remains just mentioned found on the summit of the hill there was uncovered on the east side of the hill, near the native village of Sebustyeh, the large Roman basilica, the largest and most perfect of the buildings unearthed here, with its tribune, in semicircular form, still intact, into which later Arab masonry was fitted, and below which earlier remains of places of worship could be inspected. Some work was also done in the triple colonnade, scores of whose monolith columns are seen, some erect and some prone, and all without their capitals, along the brow of the hill, which colonnade led from the tower-flanked western gate of the city to the forum and basilica on the east. Beside this the city wall was traced all round the hill, showing that it was a larger city than the present Jerusalem within the walls.

The work around the city gate on the west proved particularly interesting, for this gate has generally been connected with the story of the lepers at the time of the three years' siege by the Syrians, who, on going to the camp of the enemy rather than starve before the city gate, found it deserted, and bringing the news to the famished inhabitants, brought about the fulfilment of the saying of the man of God that on the morrow a measure of fine flour should be sold for a shekel and two measures of barley for a shekel, and that though the disbelieving officer of the king should see it, yet should he not taste of it, it transpiring that he was trodden under the feet of the eager and hungry citizens surging through the gate. Here Roman, Greek and Hebrew remains were found superimposed one on the other, betraying, among much else, this peculiarity, that whereas the towers were constructed so that they led east by north to the royal palace, yet when the Romans reared their magnificent colonnade, the angle of the gate was altered, being turned to the south so as to lead through their new covered street, lined with stately columns, to the Roman tribunal.

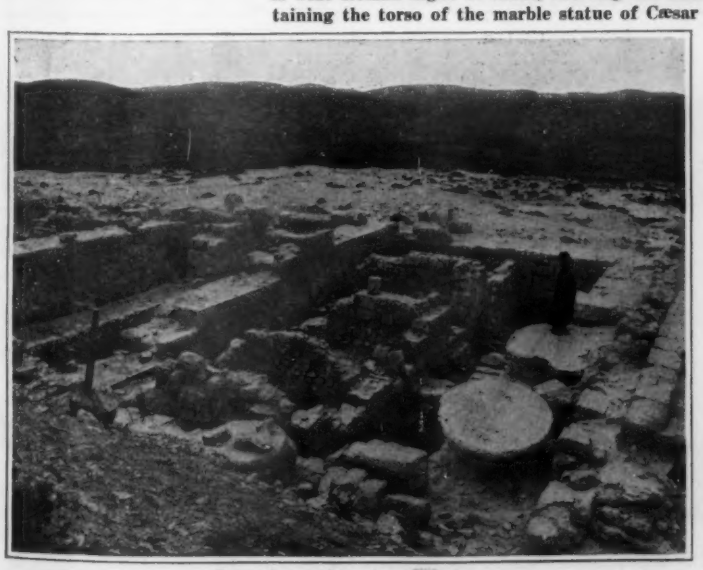
It is Dr. Reisner's intention to resume the work of excavation during the coming summer. Only a small portion of the mound has so far been explored. It is thought by many that here may be hidden valuable documents telling of the life and history of the early Jewish kings. Then it must not be forgotten that the age of Ahab is only a century away from that of David. The division of the land of Palestine into two kingdoms—one with Jerusalem as the capital and the other with Samaria as the capital—occurred only fifty-six years before the time of Ahab. Solomon and all his glories were still fresh in the memory of those still alive, and any part of the literature of this important period may be discovered when the rest of the mound of Samaria is excavated. That there are certainly some documents on clay, if not on papyrus, is indicated by the finding of a piece of the clay envelope of an Assyrian letter, with a part of the name of the man to whom it was addressed still there. The finding of even a fragment like this indicates the great probability that in the mound may be a great mass of these letters, in fact, all the records of the Northern Kingdom of Israel, for the Assyrian language was used at that time in correspondence between Palestine and Egypt, as has been proved by the Tel-el-Amarna letters discovered in Egypt a few years ago. Such letters would parallel the Biblical narrative.



Row of ancient columns of the Herodian colonnade among the ruins of Samaria.

Circular towers, with older square base, which flanked the gate of ancient Samaria.

A wide Roman flight of stairs, showing the altar. In the foreground on the right is a wooden crate, containing the torso of the marble statue of Cæsar which was found in the early stages of the excavations.



Samarian ruins viewed from the top of the Roman stairs.

The excavated Roman basilica. On the extreme right is seen the semicircular tribune.

RECENT EXCAVATIONS AT SAMARIA

Handcuff Releases Under Difficulties

The Remarkable Feats of Harry Houdini

AMONG the well known vaudeville entertainers must be mentioned Mr. Harry Houdini, whose celebrated feats with handcuffs, strait-jackets and various restraints used to confine the insane and fractious are well known. The public always seems to be interested in seeing the "other fellow" get away from a tight place, so that it is little wonder that Houdini's audiences are always large. Our attention has recently been attracted to a number of feats which he has been performing in New York and other cities, the culmination of which perhaps is the aquatic box-trick which we will now describe.

On Sunday, July 7th, Mr. Houdini invited a party of newspaper men and those interested in magic, to witness a very remarkable box-trick on New York Bay. This event was scheduled to take place at a pier on the East River, but owing to police interference the scene of operations was transferred to the deck of a large lighter which was towed to the dock of the Quartermaster's Department at Governor's Island. As this was Federal property the police could not interfere with this act.

A large wooden box, 40 inches long, 22 inches wide and 24 inches high, was provided. This box was carefully examined and no indication of panels, bolts or springs was detected. After divesting himself of his outer clothing, and after a committee had seen that he did not have any concealed keys or devices for picking the locks of the handcuffs, he submitted cheerfully to be manacled with leg irons, two pairs of handcuffs and elbow irons. Any of the spectators had the privilege of bringing their own handcuffs if they so desired, as Houdini does not care about furnishing articles of this kind when he is making his more important tests. The cover of the box was removed and Houdini crouched in it in a stooped position somewhat resembling the doubling up of a jack knife. The cover was then nailed in place with thirty-six wire nails and the entire box was banded with band iron, or as it is technically known "packed for export." On each side a length of iron sewer pipe was secured and iron sash weights were introduced into the pipe, thus affording a convenient method of weighing down the box so as to cause it to sink to the level of the water. Two hundred pounds of iron was used. Holes had been bored in it to permit the entrance of the water so that the box itself could be readily submerged. The box was then carefully roped so that no escape from it could have been possible had the nails and band irons been non-existent or have given away. Some of the planks from the lighter were removed and the box was shoved out on them and was finally dumped in the water. In exactly a minute and ten seconds Houdini emerged from the water, swimming toward the lifeboat which had been provided. The act was witnessed by thousands of spectators who crowded the decks of three ferryboats. The box was hauled onto the deck with the aid of one of the spars of the lighter and the box was carefully examined. Nothing was found in it except the useless manacles which had failed to bind Houdini under the most adverse conditions. Considering the danger of this feat and the entire absence of any paraphernalia such as traps, etc., it appears to be all the more wonderful. This may be regarded as one of the most remarkable tricks ever performed, and it is only regrettable that a feat of this magnitude cannot be tried before a larger gathering of spectators.

Houdini's box tricks, his milk can trick and similar entertaining feats will not appeal to the average person as much as his bridge dives which have taken place in all parts of the world. We are able to show two or three photographs which give an adequate idea of the remarkable nature of a feat of this kind. In one of the engravings we see Houdini with his hands manacled behind his back and his arms also confined by elbow irons. This photograph was taken just before an 89-foot jump at Sydney, Australia. The next photograph shows the agonized face of Houdini after he struck the water at the wrong angle. Blood flowed from his nose and mouth. This goes to show that the career of the professional strong man, jail breaker and handcuff king has not been altogether unfraught with danger. Several of his imitators have tried similar feats with disastrous results, such as broken ribs, and even two of them paid the penalty with their lives, being drowned with the manacles still on their wrists. Owing to the uncertainty of an act of this kind if unsuccessful it would be almost impossible to rescue and resuscitate a person before he is drowned.

A third photograph shows the position of Houdini's body in his famous jump from the Queen's Bridge, Melbourne, Australia, in March, 1910. His hands were heavily ironed behind his back with handcuffs and he succeeded in reaching the surface in a surprisingly short space of time. In this case he was under water about two minutes. A gruesome incident occurred at the time of this dive. The shock of Mr. Houdini striking the water was great enough to bring to the surface the body of a man who had been drowned some days before, thus naturally adding greatly to the excitement.

We do not pretend to give any explanation of Houdini's performances. We can only say that he states that most of the public *exposés* of tricks of this kind are absolutely worthless, as they would not work in practice under the severe conditions of a committee of examination. Possibly some of our readers have original solutions of these mysteries; if so, we should be pleased to hear from them.

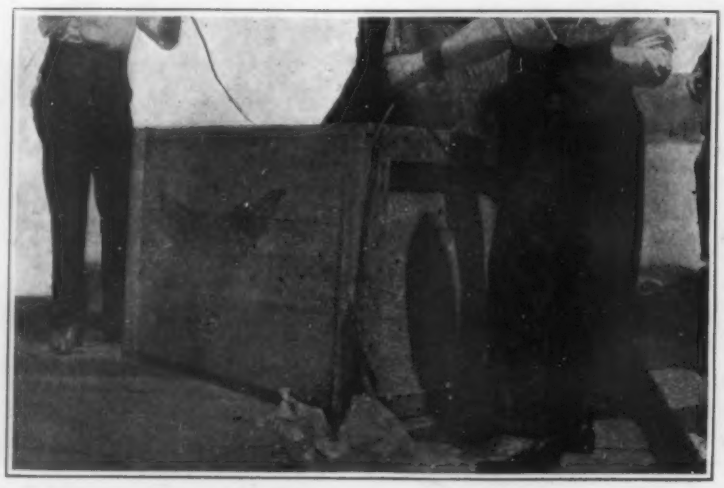
Houdini injured after an Australian dive.

Preparing for the manacled plunge.

A daring dive in handcuffs.

Houdini manacled preparing to enter the box.

Lowering the box into the Bay.



The aquatic prison box.—Nailing up the case with the aid of band iron, Houdini inside.

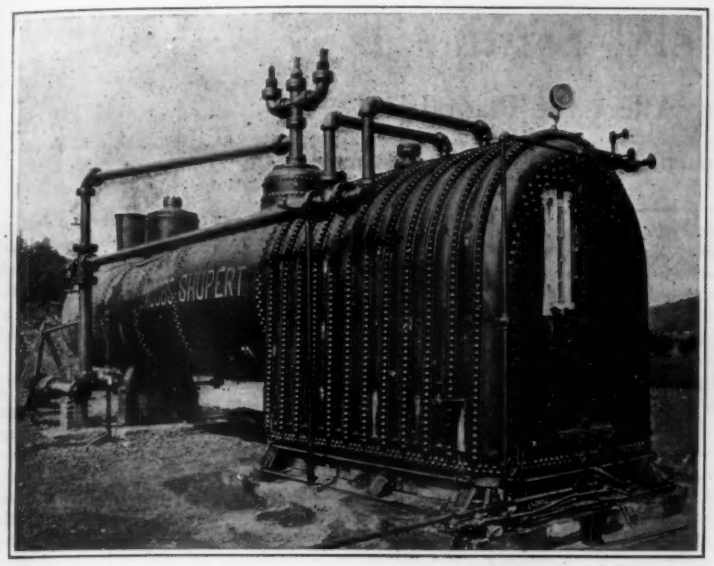
THE DARING FEATS OF HARRY HOUDINI

The Current Supplement

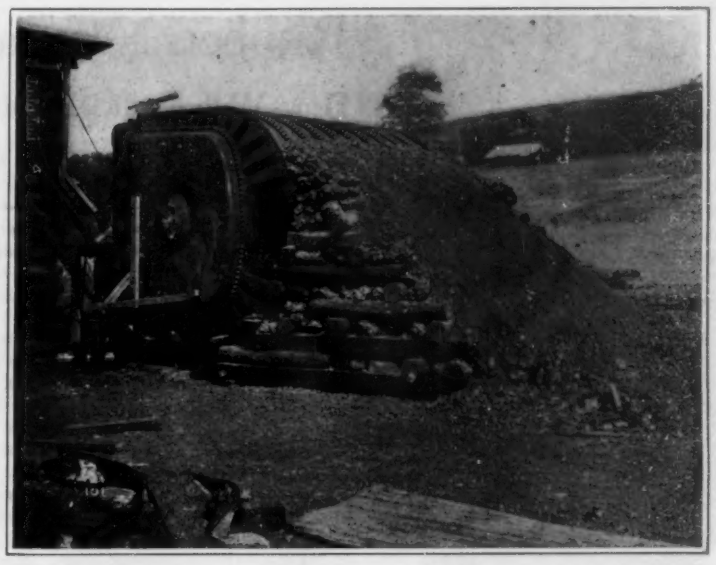
THE manufacture of fuel briquettes in this country is a growing and important industry. Some significant statistics on this subject have been collected by Edward W. Parker, of the United States Geological Survey, and are summarized in an article appearing in the current issue of the SUPPLEMENT, No. 1907.—H. S. Munroe writes on the toxic effects of carbon monoxide.—Prof. Bickerton contributes a very interesting article on the origin of the Milky Way.—Dr. Zahm's masterly contribution on aeromechanics is continued in this number.—Reginald R. Gordon gives a report on the 1912 Convention of the American Railway Master Mechanics' Association. This report is full of important facts, which no one interested in railroading can afford to leave unread.—Our Berlin correspondent describes in an illustrated article the laying of a cable through the River Trave.—Dr. Cannon continues his splendid article on Animal Experimentation.—Prof. Fleming, the great English electrical engineer, contributes an article on the conductivity of dielectrics.

Copper Mines in Nova Zembla

PROSPECTING for minerals in the Arctic and Antarctic regions is one of the interesting developments of recent enterprise. The latest news under this head is that valuable deposits of copper have been found in Nova Zembla. Funds for working these deposits have been advanced by a banker in Odessa, and a party of engineers and workmen, mostly from the Ural, will proceed in a special steamer to this far northern field.



The sectional firebox boiler intact after the test.



"Bomb-proof" from which boilers were operated and observed. Note telescope.

Blowing Up a Locomotive Boiler

Test of a New Type of Safety Boiler

THE statistics gathered by the State Railroad Commission show that every year an average of fifty locomotive boilers explode, causing a damage to property of several millions of dollars and the loss of more or less than one hundred lives, to say nothing of injuries to a larger number of people. The careful investigations which are carried out under the Commission usually lay bare the defects or mismanagement which led to the disasters; but in many cases it is difficult, and indeed impossible, to determine the cause. Low water in the boiler, due to carelessness or oversight on the part of the fireman, accounts for a large number of explosions. Should the water level fall to such a point that the crown, or roof as it might be called, of the firebox is uncovered, the great heat of the fire raises the temperature to a point at which the metal loses its strength and yields under the steam pressure, tearing loose from the staybolts which normally hold it in position.

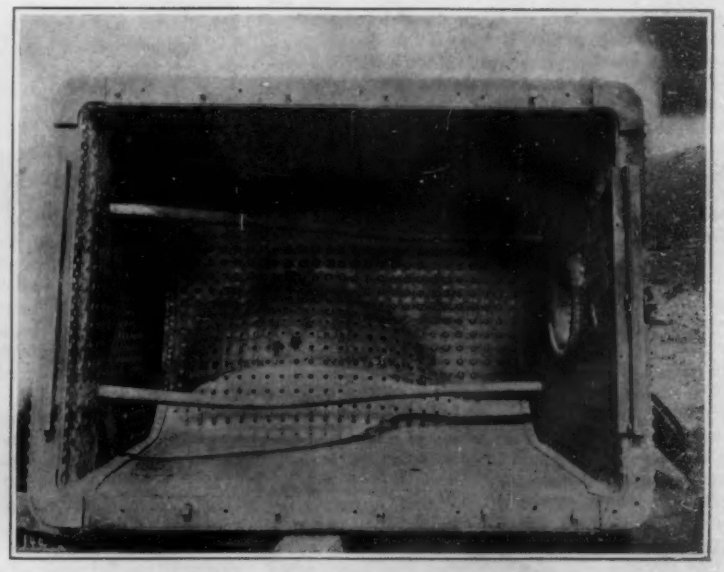
In the standard type of locomotive, the firebox is held to shape against the inward pressure by tying it to the outer shell of the boiler with a large number of staybolts. Under normal conditions this construction is sufficient for its purpose. But should the crown of the firebox become overheated through the water falling below its surface and exposing it to the full heat of the fire, the heads of the staybolts and the holes in the crown, softened by the heat, are no longer able to hold against the pressure. The bolts are pulled through, and the crown is crushed in. Of all the causes which lead to boiler explosions, this is probably the most frequent. Among the many attempts to build a boiler which would be proof against this form of accident, the most successful is that known as the Jacobs-Shupert sectional firebox, which was built several years ago in the mechanical department of the Santa Fé Railroad Company from the plans of the two engineers whose names it bears. A large number of these fireboxes have been built and are in service on the Santa Fé and other railroads, where they have rendered excellent service. In order to test the qualities of this boiler, it was submitted to investigation by Dr. W. F. M. Goss, Dean of the College of Engineering, University of Illinois. Dr. Goss is probably the best known authority in work of this kind; and in investigating this particular boiler, it was determined to make a test on a hitherto unprecedented scale, to determine how far it was proof against explosion due to low water, and at the same time to determine whether low water was a sure cause of explosion when it occurred on boilers of the standard radial-stay type.

The explosion of the radial-stay firebox boiler.

The demonstration was made at Coatesville, Pa., on June 20th of this year, before a large gathering composed chiefly of engineers representing various departments of engineering. Two full-size locomotive boilers, designed for high speed heavy passenger service, were each subjected to severe low-water tests. Both boilers were identical in size and design except that one had a Jacobs-Shupert sectional firebox, while the other had an ordinary radial-stay firebox. In carrying out the test, both boilers were mounted in a field, fifty feet apart, and they were operated from a "bomb-proof" located two hundred feet away from the nearest boiler. Because of the danger to which a fireman shoveling coal would have been exposed, oil was used for fuel. Grad-

(Concluded on page 66.)

Interior of Jacobs-Shupert firebox, showing structure intact after exposure to intense heat.



Crown of the radial-stay furnace, bulged in after it was torn loose from the stay-bolts.

Rubber Natural and Synthetic

How Will Artificial Rubber Affect the Plantation?

By Prof. F. Willy Hinrichsen, of the Koenigliches Material-Pruefungsamt, Berlin

IN the last few years the world's consumption of caoutchouc has increased at an extraordinary rate, indeed, so extraordinary, that the supply has not been able to keep up with the demand. The following table statistically summarizes this remarkable increase:

World Production and World Consumption of Caoutchouc.

Years.	World Production in Tons.	World Consumption in Tons.
1899-1900	53,348	48,352
1900-1901	52,864	51,136
1901-1902	53,887	51,110
1902-1903	55,603	55,276
1903-1904	61,759	59,666
1904-1905	68,879	65,083
1905-1906	67,999	62,754
1906-1907	74,023	68,173
1907-1908	66,379	62,376
1908-1909	70,587	71,998
1909-1910	76,553	76,026
1910-1911	79,305	74,082

From this table it appears that the consumption of rubber in the year 1908-1909 (the financial year being usually reckoned from July 1st to the following June 30th) exceeded the production. Had it not been for large reserves of raw caoutchouc left over from previous years, the commercial situation might have been alarming.

The Price of Raw Rubber.

This unfavorable relation between production and consumption naturally resulted in a considerable rise in the market price of rubber. The increase in price which would have normally resulted would have been serious enough, but thanks to the stock jobber, rubber brought 12 shillings 6 pence per pound in May, 1910. After that there was a drop. In June, 1911, the price of raw caoutchouc reached a minimum of less than 4 shillings. Then came another increase. The prices that I have here quoted are those for the best quality of Brazilian Para rubber.

The payment of such fabulous sums for natural rubber stimulated efforts to produce rubber artificially, in sufficient quantities and at sufficiently low prices to compete with Para gum. I take it that readers of the SCIENTIFIC AMERICAN are more or less familiar with the methods employed in obtaining natural rubber. Caoutchouc is found in the milky juice (latex) of certain plants, which flows out when the bark is pierced. By proper treatment this milk is converted into caoutchouc. In separating or coagulating caoutchouc the action of heat or chemicals is most important.

Rubber Plantations.

Because the production of natural gum is not sufficient to keep pace with the constantly increasing demand, the more so since whole trees are felled and other most ruthless methods are resorted to, caoutchouc producers have for some years past carried on the cultivation of the rubber tree on plantations. Their rubber may even now be considered the most promising competitor of the wild tree. Enormous areas, especially in Asia (the Malay States, Ceylon, etc.), have been planted with caoutchouc trees. The growth of these trees is rapid, and the amount of caoutchouc annually produced by plantations is constantly increasing. By careful study the most favorable conditions for cultivation—especially the conditions of soil and the most convenient method of coagulation—have been ascertained. In fact, plantation caoutchouc is even now almost as good as Brazilian Para gum. It has brought prices just as high.

More interesting, sensationally so, in fact, is the production of rubber by artificial means, rubber which in its chemical and physical properties is exactly the same as natural rubber.

How Rubber is Made in the Laboratory.

Caoutchouc proper is a compound of carbon and hydrogen, a compound in which these two elements bear the same relation to each other as in a certain well-known class of bodies called terpenes, the main constituents of ethereal oils. From these terpenes some well-known aromatic substances are derived among others. In order to ascertain the manner in which atoms of carbon and hydrogen are fixed in caoutchouc, the chemist must first decompose the caoutchouc, split it up, in other words. If he can do this completely he can obviously discover exactly what elements are required to make caoutchouc. When that mystery is revealed his next task is to take the elements of which caoutchouc is composed and to combine them in the proper way in order to produce artificially a rubber which is chemically the same as the substance obtained from the Hevea tree. Stated thus baldly the problem seems very simple. Yet more than a decade of arduous chemical research has been required before rubber was synthetically produced in the laboratory.

[The author of this article, Prof. Hinrichsen, has completed for the Koenigliches Material-Pruefungsamt what may well be regarded as a most thorough study of natural rubber, artificial rubber and rubber substitutes. For that reason his comments on the commercial possibilities of the synthetic rubber discovered in Germany deserve more than passing attention. An entirely new significance and interest has been added to the topic by the recent authoritative announcement that a body of English chemists have surmounted the last difficulties in the synthesis of rubber, and have placed it upon what promises to be a sound commercial basis. Prof. Hinrichsen's article was written before this announcement, and is published here in its original form. The reader must supplement his information by reference to our editorial page.
—EDITOR.]

Among the constituents of rubber which are split up by intense heat is a liquid which boils at a low temperature and which in odor and in boiling point closely resembles ordinary ether. That substance is known as isoprene and was discovered by Williams as far back as 1860. Indeed, isoprene proved to be a compound of carbon and hydrogen in about the same proportions as they are found in rubber itself.

Bouchardat, in the course of a comprehensive investigation, found that isoprene, under given conditions, was converted into a substance analogous to caoutchouc. Other experimenters made the same observation later, among them Tilden and Wallach. Frequently, however, the conversion failed to take place. Why? Because the exact experimental conditions which governed the conversion of isoprene into caoutchouc had not yet been ascertained. The failures were so numerous that chemists began to doubt the correctness of earlier observations. It was not before 1909, when F. Hofmann and C. Coutelle, two chemists in the employ of one of the largest chemical works in Germany, found that absolutely pure isoprene is converted into a substance resembling caoutchouc if heated under pressure with and without the intervention of other substances. Independently of these experimenters, C. Harries, at Kiel, discovered the same reaction while heating isoprene with acetic acid.

The Commercial Possibilities of Artificial Rubber.

These experiments have solved the problem of producing rubber synthetically, but as yet only from a scientific point of view. It may here be added that if the initial material be varied in quality and the experimental conditions modified, a number of substances which resemble caoutchouc can be obtained, which are not to be found in nature.

Naturally the business man asks: What is the practical value of this work? Is synthetic rubber merely a laboratory curiosity? Or, can it be produced in marketable quantities at a price to compete with Para gum?

If artificial rubber is to take the place of the natural product, it must be produced more cheaply than Para gum and it must possess all the really essential properties of Para gum. Whether or not artificial rubber can compete with natural rubber depends on so many commercial conditions, it is hard to give a definite answer. Some day it will compete; that much is certain. When that day will dawn, is decidedly uncertain. The struggle is bound to be a hard one. The price of Para gum will surely drop as the caoutchouc plantations are extended and as their annual production increases. The cost of producing a pound of first-class Asiatic plantation rubber is somewhat less than 25 cents. It is possible that even if it costs more to produce artificial than natural rubber, the new laboratory product may have a commercial future if it proves superior in important respects to the natural product.

On the whole, it is not likely that artificial rubber will entirely displace natural and plantation gum, as the coal tar dyes have displaced vegetable dyes. In all probability the natural and artificial products will be sold side by side in the market much as natural and artificial silk are now sold.

The manufacturing cost of artificial rubber depends primarily upon the cost of the raw material from which it is made, isoprene or related hydrocarbons. Patents have recently been taken out to cover processes designed to reduce the cost of the raw material. Isoprene, itself, is obtained not simply from heated caoutchouc but also from turpentine oil and from certain components of coal tar (cresol). Naturally, for practical purposes the isoprene must be obtained from some other source than caoutchouc.

Rubber Substitutes.

Long before artificial rubber was successfully produced various compounds had been discovered which had many of the properties of rubber, but were chemically different from it. Many of these are compounds of oil, shellac and similar substances. Such rubber substitutes, "factices," the French call them, are obtained by treating oils with sulphur chloride, in which case a white rubber-like substance is obtained; or with sulphur alone, in which case a brown imitation rubber is produced. Mixtures of such oil, or sulphur compounds with caoutchouc have proved convenient and serviceable. They seem to last longer than rubber. The imitations or factices themselves, depending upon their process of manufacture, are usually loose and brittle masses of a white or brown color, to be distinguished from rubber by their ready saponification; in other words, they are easily attacked by lyes.

In the patent literature of every country will be found descriptions of plastic masses made from glue, gelatine, cellulose and the like—all alleged to be perfect substitutes for rubber. Some of these have proved of industrial importance. Most of them are valueless because of their inferior elasticity.

Regenerated Rubber.

Foremost among the substitutes for pure rubber may be mentioned regenerated rubber obtained from refuse articles of manufactured rubber. Because of the small supply of natural caoutchouc, the necessity of utilizing the refuse of rubber factories had become almost pressing. According to authoritative estimates, the quantity of old rubber regenerated for the manufacture of rubber articles surpasses the consumption of raw caoutchouc. Such reclaimed rubber is no perfect substitute for new gum. It has lost much of elasticity and strength by the mechanical, physical and chemical processes to which it is subjected. Old rubber shoes, pneumatic tires and the like constitute the raw material from which regenerated rubber is made. When reclaimed the rubber differs in a marked degree from caoutchouc.

Every one knows at this late day that all rubber articles must be vulcanized, in other words, that at certain temperatures sulphur in some form must be added. Although the actual chemical process that occurs when sulphur is thus added is not yet known with absolute certainty, recent investigations show that part of the sulphur compounds are chemically fixed by the caoutchouc. This "combined" sulphur, as it is called, is not eliminated from present regenerated material. In actual practice, the reclaiming or regenerating process destroys the fabrics in the old rubber and converts the remaining vulcanized rubber to a plastic form for further manipulation.

There is no good reason why the sulphur combined with vulcanized rubber could not be removed, theoretically, at least. Most rubber experts, however, have come to the conclusion that the task is hopeless.

Some apprehension has been expressed lest the continual increase in the production of plantation rubber should result in an over-production. Such apprehensions are groundless. Even if the plantations should continue to produce rubber at the present rate, and even if synthetic rubber should also be manufactured, the demand for the natural product will not abate. The quantity of caoutchouc which the world needs is so great that all available sources of supply will be drawn upon. The price, of course, will fall; but that, again, will be offset by increased consumption.

If it were possible for manufacturers to employ synthetic rubber, natural rubber and plantation rubber at very much lower prices than are at present charged, there would be no doubt that the world at large would benefit. The possibilities of rubber are far from being exhausted. The high cost of the raw gum has hitherto limited the applications of one of the most useful substances in the world. When the price of rubber does fall, because new sources of supply have been made available, we may possibly speak of a "rubber age." It is not too romantic to imagine how noiseless would be the street traffic of large cities when rubber becomes so cheap that every vehicle will be rubber-tired, and when even pavements will be made of rubber, which last possibility is not wildly extravagant, inasmuch as rubber pavements have already been used with excellent results.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Cigar-banding by Machine

THERE is usually but one right way of doing a thing as against a large number of wrong ways. In few cases, however, does the disparity between right and wrong ways reach such enormous figures as in the re-packing of banded cigars. The situation is this:

Custom demands that cigars be packed so tightly in the box that they lose their rounded shape and are flattened one against the other. This result is obtained by placing the well-filled box in a mechanical press and leaving it under compression for a number of hours. At the end of that time each cigar is found to possess an individuality of its own. It is unlike any of its fellows. It has yielded here and there to accommodate itself to the crowding and pressing of adjacent cigars. It is of such irregular form that it will not fit in any other position in the box. Obviously, it would not do to band this cigar before it had assumed its final form, for otherwise the band would not fit snugly, and it would be mussed and crumpled in the press. Therefore, it is necessary to remove the cigars from the box after they have been compressed, and band them separately one by one, replacing them in their original container in the same order as they occupied under the press. Unless care is taken to restore each cigar to its original position, trouble is sure to ensue. Once the order is lost, the chances of rediscovering the original arrangement are hopelessly against the operator. Consider a single row of twelve cigars. It is a simple mathematical problem. Multiply 1x2x3, etc., up to 12, and the result will be 479,001,600 different ways in which those twelve cigars may be arranged. If we consider an entire boxful of cigars, the number of wrong ways in which they can be put in the box will reach such a stupendous figure as to pass entirely beyond the comprehension of anyone but an astronomer. Realizing this as well as the fact that objects not uniform in shape are difficult to handle, cigar manufacturers have declared stoutly that the banding of cigars after having been packed could never be accomplished by machine.

According to the latest report of the Internal Revenue Department, there are some 25,000 cigar manufacturers in the United States, making about eight billion cigars per year, and it is conservatively estimated that fully six billion of these are banded. As all this work is now done by hand, this means that there are six billion separate hand operations requisite. The work is done by girls at almost incredible speed. Yet the cost of banding runs up into the millions of dollars per annum, and imposes a heavy burden on the cigar industry. A number of years ago a banding machine was invented for banding loose cigars. However, as the number of unpacked banded cigars is comparatively small, this machine did very little toward relieving the situation.

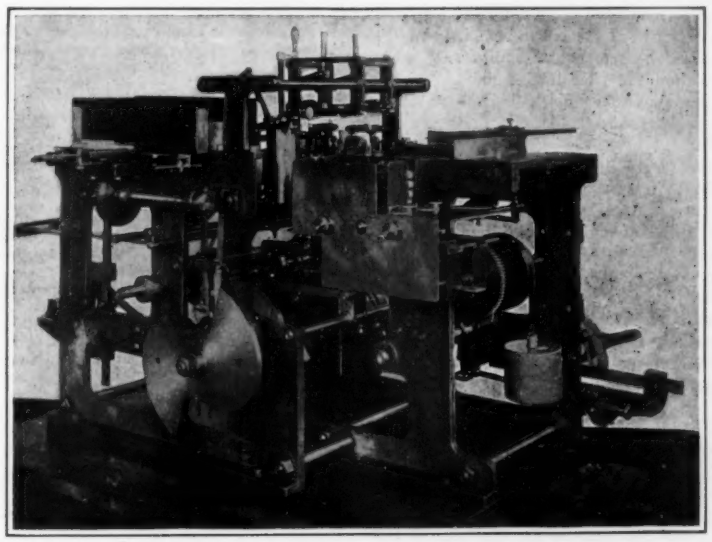
About a year ago, we described a machine which had just been built for banding packed cigars. While that machine did actually band cigars, after they had been packed, it was not adaptable to certain special demands of the cigar manufacturer.

Accordingly, a second design has been developed, which is shown in the accompanying illustrations. This machine is so improved and simplified as to appear like an entirely different mechanism. It will take the cigars from a box, band each one separately, place the band in the center, or at any other desired point on the cigar, reverse the band for alternate rows, if so desired, and restore all the cigars to the box, doing the work at the rate of about 60 per minute with a single operator, as against two in the old machine.

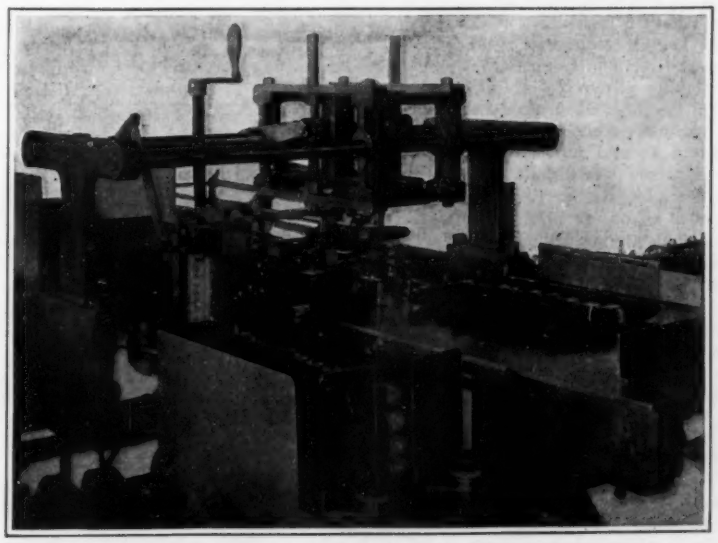
The cigars are removed from the box and placed on a tray without disturbing their relative order. The tray is then placed in the container shown at the left-hand side of one of our photographs, and thence the cigars are moved row by row out upon a receiving table. The most conspicuous object in this photograph is a cam with two broad wings. When the cam roller drops off the point of one of the wings to the base of the other, it acts to eject the bottom row of cigars from the tray. Thereupon the ejector is slowly retracted, until, by the time the first row has passed through the banding mechanism, it will be ready to eject the next row in the tray. The cigars are picked up one by one from the receiving table by a forked suction tube and placed on a pair of fingers or hollow stems of rubber, connected with a vacuum pump, so that they will hold the cigar firmly by suction, yet without danger of injuring the wrapper. Before the cigar is carried to the banding point, a suction finger rises vertically and removes a band from the bottom of a pile placed directly above the banding point. The cigar is then carried over the band and pressed down with it between a pair of spring-pressed guide-plates shown at *A* in the line drawing, which fold the paper closely around three sides of the cigar. Thereupon a tucker plate *B* folds one end of the band down upon the cigar. Above the tucker plate is a gumming device, consisting of a tube terminating in an inclined plate *C* provided with two small perforations. Through these perforations two beads of gum about the size of a pin-head are squeezed out on the plate and are wiped off upon the other end of the band as it is folded down by means of a rubber-coated roller *D*. At the same time the tucker plate and gumming device are withdrawn, the tucker plate serving to shield the cigar-band from gum scraped off the gummed end. Above the gumming device is a plate *E*, which serves as a guard to prevent the band from coming in contact with the gum as it is drawn down into position to receive the cigar. While the cigar is being banded the rubber fingers which carry it to that position return to get another cigar, while a second pair of suction fingers take the banded cigar and carry it over to a delivery table. Thus the process is continued until a complete row of cigars has been delivered, whereupon a pusher slide moves the entire row endwise into the tray shown in the foreground of the photograph at the right of the machine. After receiving a row, this container moves down to the proper position for the second row, and when the entire box of cigars has been banded the cigar box is inverted and placed over the tray. It will be noted that the arrangement of the cigars in the tray at the delivery end is exactly the same as that at the receiving end. The box and tray are now revolved together so as to bring the box right side up, whereupon the cigars are forced out into the box, as shown in one of the illustrations. The tray is double, so that when it is revolved to discharge one section, a second section is brought into position, and the work of the machine can proceed without interruption.

In our enlarged view of a portion of the machine may be seen a small hand crank upon a threaded vertical shaft. This shaft forms the plunger rod that projects from the gum cylinder. A ratchet mechanism is operated to feed the plunger down as each cigar comes to the banding position. The amount of gum required for each band is so minute that a reducing gear is required between the ratchet and the plunger. At each operation of the ratchet the plunger is made to move down one ten-thousandth of an inch. The actual amount of gum in each bead on the gum plate is 0.0001 cubic inch. The cylinder is large enough to store a day's supply. To refill the cylinder, the hand crank is operated to withdraw the plunger and thus suck in the gum.

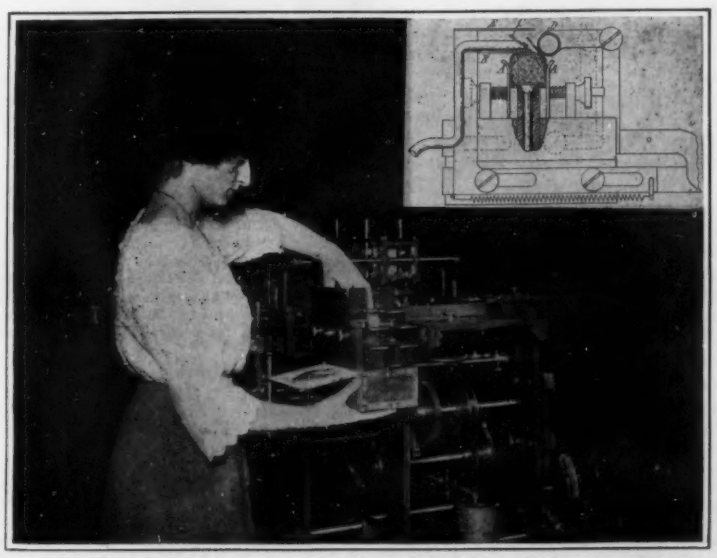
Some dealers prefer to have the bands applied near one end of the cigars instead of centrally. To provide for this an end-stop is used for the ejector slide, and by adjusting this stop with respect to the banding point the position of the band upon the cigar may be determined. When it is desired to reverse the bands in alternate rows, a cam connection is made, which causes the suction finger, as well as the entire banding mechanism, to revolve through an angle of 180 degrees after each band is removed from the pile, thus reversing the position of the band. This reversal will continue for the entire row of cigars, after which the parts will be turned to normal position and there will be no reversal while the next row of bands is being applied.



General view of the cigar-banding machine.



A cigar leaving the banding mechanism, a band being lowered for the next cigar.



Forcing the cigars out of the tray into the box. Insert shows the banding mechanism.

It is customary to pack cigars in rows of 12 and 13 alternately, or in rows of 10 each. The mechanism is arranged to accommodate itself to such packing. The cam shaft which feeds the cigars to the receiving table and controls the feed from the delivery table is moved by a ratchet mechanism. Two ratchet wheels are provided, one of which has 13 teeth on one half and 12 on the other, while the second ratchet wheel has the same number of teeth on each half. When the ratchet pawl is thrown into the former ratchet wheel it will feed the shafts at the rate of 13 steps for one-half revolution, and 12 steps for the other. When, however, the ratchet pawl is thrown into the other wheel, the feed will be uniform. Another adjustment provides for regulating the machine to handle boxes of 25, 50 or 100 cigars. A ratchet wheel with 100 teeth is employed, and if there are 100 cigars to the box the pawl engages 1 tooth at a time; if 50 to the box, 2 teeth at a time; and if 25 to the box, 4 teeth at a time. The machine can thus be adjusted to practically every requirement of the industry.

The Trade-mark as a Business Asset

By W. E. Woodward

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[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the second of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

The Federal Trade-mark Law—II.

The function of a trade-mark is to denote origin.

Throughout its history the trade-mark has remained true to its ancient antecedents, and its purpose to-day, as it was in the fifteenth century, is specifically to indicate the origin of an article of merchandise.

In this aspect of unchanging purpose, the trade-mark is somewhat an anomaly in commercial history. During the last four hundred years, methods of manufacture, distribution and sale have been revolutionized from top to bottom: banks, which began as mere money-changing offices, have become establishments for keeping and loaning funds; the retailer, who used to sit in a hole in the wall with a handful of goods, all of the same kind, has developed into a merchant selling ten thousand different articles; the craftsman, who once served a long apprenticeship, during which he learned to make every part of a shoe or a carriage, has become a specialized laborer, employed only the day to produce the extreme subdivision of a finished article.

The reader should understand clearly that the right to own a trade-mark is not a creation of the statute, for the use of trade-marks, and the recognized right of manufacturers to be protected in their use, far ante-date any specific trade-mark legislation.

The intent of the statute is to systematize and codify trade-mark practice. It provides a definite procedure for the registration of trade-marks, lays down rules for validity in marks, puts trade-mark litigation, when registered trade-marks are the subject matter of the litigation, within the jurisdiction of the Federal courts; and makes every trade-mark registered under the law a part of the public records of the nation. But a trade-mark may be legally sound even if not registered, just as a person may own real estate without recording the title.

The ownership of trade-marks, like every other property right, is recognized by the common law. The Supreme Court of the United States has said: "The right to adopt and use a symbol or device to distinguish the goods or property made or sold by the person whose mark it is, to the exclusion of use by all other persons, has been long recognized by the common law and the chancery courts of England and of this country. It is a property right for the violation of which damage may be recovered in an action at law, and the continued violation of it will be enjoined by a court of equity with compensation for past infringements."

Trade-marks, under the Act of 1905, are registered in the United States Patent Office.

In case of litigation resulting over the right to use any trade-mark, evidence of the registration of the mark by one of the litigants puts the burden of proof upon the other. In other words, the user of the unregistered trade-mark must prove priority of use and ownership. This is often a very difficult thing to do, especially in the case of trade-marks that have been used a long time, for such proof must necessarily rest upon the production of old labels, packages of the goods with the trade-mark affixed, and testimony of witnesses.

The owner of a registered trade-mark does not need any evidence other than the public records of the Patent Office to establish the date of his first use of the mark.

When a trade-mark is not registered in the Patent Office, litigation concerning it does not come under the jurisdiction of the Federal courts, unless the opposing parties are citizens of different States.

On the other hand, all cases pertaining to registered trade-marks fall within the field of Federal jurisdiction, irrespective of the amount in dispute or the place of residence of the parties. There is an obvious advantage in this, owing to the fact that an injunction secured in one Federal court will be enforced in all such courts in any State.

The fee charged by the Patent Office, under the law, for registering a trade-mark is ten dollars. This does not include the attorney's fee, which must be paid by the applicant.

A certificate of registration remains in force for twenty years, and it may be renewed upon expiration, for like periods of twenty years, upon payment of a renewal fee of ten dollars.

An individual or corporation has a right to register a trade-mark under the United States law if the trade-mark for which registration is sought belongs to the applicant and is used by him:

1. In commerce among the several States.
2. Or, in commerce with foreign nations.
3. Or, in commerce with the Indian tribes.

Provided the owner of the trade-mark resides within the territory of the United States (which includes all territory under the United States control), or has a business establishment situated in United States territory, or resides in any foreign country which affords, by treaty, similar privileges to citizens of the United States.

Divested of legal verbiage, the main provisions of the Act, so far as the features governing registration are concerned, may be stated as follows:

A trade-mark is not registrable if it is:

A design or wording identical with a registered or known trade-mark owned and in use by another, and appropriated to merchandise of the same descriptive qualities, or which so nearly resembles a registered or known trade-mark owned and used by another, and appropriated to merchandise of the same descriptive qualities, as to deceive purchasers, or to be likely to cause confusion in the mind of the public.

The insignia of the American National Red Cross Society.

The flag or coat of arms of any foreign nation.

Any design or picture which has been adopted by a fraternal society as its emblem.

A portrait of a living individual unless the application for registration is accompanied by the written consent of the individual whose portrait is used.

Scandalous or immoral matter of any description.

The flag or coat of arms of the United States, or of any State, or of any municipality, or any of the insignia thereof.

Any geographical name or term.

A misrepresentation of the quality, composition, character, origin, or nature of the commodity with which it is used.

Any mark which consists merely in the name of an individual, firm, corporation, or association, unless said name is written, printed, impressed or woven in some particular or distinctive manner, or is used in connection with a portrait of the individual.

Any arrangement of words or devices descriptive of the goods with which they are used, or of the character or quality of such goods. In other words, a trade-mark must not be an advertisement in the ordinary sense of the word.

A trade-mark is registrable if it is:

Unlike any other trade-mark already in use, and applied to the same class of goods. It must not resemble the trade-mark of a competitor, or of a potential competitor, to such an extent that the buying public is likely to be deceived or confused by the resemblance.

The business name of a person or firm when written, printed, impressed or woven in some distinctive manner, or in association with a portrait, or in an autographic form.

Any trade-mark symbol, or word, or words, or a combination of a device and wording, not obviously descriptive of the commodity to which it is to be applied.

Any trade-mark which has been in continuous and exclusive use by the applicant since February 21st, 1895.

Used in lawful trade.

Of such a character that it may be affixed, printed upon, woven, sewed, branded or otherwise impressed upon the product with which it is used, or upon the package or container of the product.

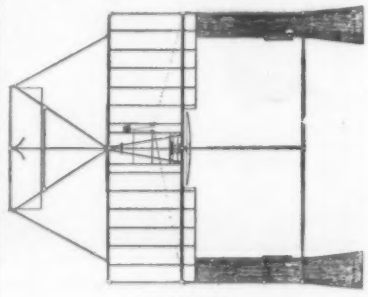
(*To be continued.*)

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

AEROPLANE.—LOUIS F. BANCROFT, 36 Pearl St., Hartford, Conn. This invention relates to a novel form of aeroplane, and more particularly to one having automatic stabilizing devices co-acting therewith. An object is to provide means for automatically maintaining or restoring the lateral and longitudinal balance of the aeroplane. Further, an object



AEROPLANE.

is to provide an aeroplane having stabilizing surfaces and guiding elements which may be manually operated to convert the same into additional stabilizing elements. The inventor has on many occasions proved that transverse and longitudinal stability of his flying machine has been automatically maintained. The aeroplane is shown in a plan view equipped with a preferred embodiment of the invention.

WING FOR FLYING MACHINES.—G. KORP, Hamburg, Germany. This invention comprehends a wing having a longitudinal tapering staff made of material more or less resilient, the smaller end of the staff extending to, and in part constituting the tip of the wing, together with feathers, each having a stem and one or more fins extending from the stem, each fin being of composite structure.

Electrical Devices.

INSULATOR.—H. LANGE, Kiel, and F. DRUCKENMÜLLER, Cologne-Nippes, Germany. This invention provides an insulator to be used in connection with high-tension conductors of over-head electric systems for wireless telegraphy and telephony, as well as with supporting tackle used with the masts of wireless telegraph systems, which possesses great strength, is of high resistive power, presents a large surface, is of small circumference and light weight, and which can be inexpensively produced.

DISSOLVING VIEW DISPLAY APPARATUS.—G. T. FIELDING, JR., 2969 Decatur Ave., N. Y., N. Y. This invention relates to electrically controlled changeable exhibiting apparatus, and its object is to provide a new and improved dissolving view apparatus, in which the display matter gradually appears and disappears to produce a highly interesting effect to the onlooker.

BURGLAR ALARM.—G. DI GIOVANNI, 1488 Washington Ave., Bronx, N. Y. This improvement relates to burglar alarms, the more particular purpose being to provide an electric alarm associated with a number of cords so arranged that the cutting of any cord, or the stretching of any cord, as the case may be, will cause the alarm to be actuated.

SPARK ARRESTER.—B. C. MOXLEY, Box 631, Hoquiam, Wash. Mr. Moxley has for the object of his invention the provision of a simple inexpensive device capable of attachment to any stack without change in the same, and without diminishing the draft, by means of which the unconsumed solid matters ejected from the stack will be held in the arrester.

Of Interest to Farmers.

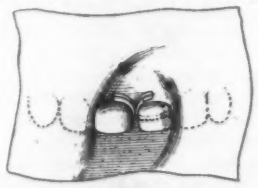
PLOW BEAM.—J. M. RIVERS, Lock Box, 234, Fort Meade, Fla. This invention is an improvement in plow beams and has for an object the provision of a novel construction of metallic beam which will be light, will effectively serve its purpose and will permit the adjustment of the different parts as desired in the practical use of the machine.

BROODER.—G. H. LEE, 1115 Harney St., Omaha, Neb. This invention provides a brooder with a movable or portable hover; constructs and arranges the hover so as to alternately confine the chicks under the hover or to free them therefrom; provides a hover open at the top to receive heat producing and heat retaining accessories if required, and means to limit the extent of the brooder.

Of General Interest.

REMOVABLE HEAD FOR BARRELS AND LIKE RECEPTACLES.—G. W. STAPLES, care of A. W. MARSHALL, Anahuac, Texas. This head is particularly adapted for metallic barrels and like receptacles. The body of the barrel is provided interiorly with a fixed ledge or flange upon which the head is supported and to which it may be clamped by means of devices that include a hasp adapted to be secured by a padlock or other device.

DENTAL APPLIANCE.—DR. W. F. DAVISON, 319 E. Main St., Richmond, Va. In the use of this easily applied device, the rubber dam is applied to two adjacent teeth, it may be in the ordinary manner. A wedge is then pressed between the teeth below and in close



DENTAL APPLIANCE.

proximity to the outer side of the rubber dam until the wedge clamps by its wedging action between the teeth. The inner and the outer ends of the wedge are then bent to secure the wedge in place and to hold the dam out of the way. The illustration herewith presents a front elevation of the invention as in use.

DEVICE FOR MEASURING DRAFT ANIMALS FOR COLLARS.—D. S. BROWN, Watertown, N. Y. The object of the present invention is to provide a simple and inexpensive device by means of which the exact measurement of the neck of the draft animal from the largest to the smallest size, may be obtained. When not in use, the device may be hung up, by engaging the hook with a nail or the like, the catch preventing withdrawal of the bar.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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A Hangar Ship

By Capt. W. Irving Chambers, U. S. Navy

I HAVE received numerous requests from leading papers and magazines to supply details of a "hangar ship" which I am credited with having recommended to the Navy Department, and, as the idea of a hangar ship seems to have captivated many who are interested in the development of naval aviation, it seems necessary to publish the facts and to correct a false impression as to my attitude in the matter.

I have never made any such recommendation for the reason that I do not believe that we need such a vessel, even if we could get it. If it is not needed a grave error would be made in asking Congress to consider the proposition.

My views on this subject may be found recorded in the Proceedings of the U. S. Naval Institute for June, 1912, page 745, where, in the discussion of the able article on Naval Aviation by Lieut. Lapointe, of the French navy, I say, "I am quite sure that the majority of our naval officers will agree with this writer on the relative importance of 'capital ships' and auxiliaries."

The reference may be found on page 650 and reads as follows:

"I agree that the navy should be made up of ships, as many ships as possible for the money available. But I also believe that these ships should be of the type to assure victory in battle—battleships—'capital ships.' Cruisers, scouts, destroyers, torpedo boats and submarines are all auxiliary to the battle fleet. Though such auxiliaries are many, their importance must not be exaggerated to the point of spending on them half, or more than half, of our appropriation, as has recently been done. The navy has suffered from a craze for flotillas of useless and costly auxiliaries of every type, whose only reason for existence is a supposed economy.

"A short time ago the true state of affairs was realized, and the construction of torpedo boats and cruisers was discontinued."

And on page 653 he states: "But it is evidently a great advantage to have an aeroplane stationed on a ship from which it can be launched and upon which it can land. For such a purpose a *garage vessel* has been proposed to accompany the fleet and shelter a half dozen aerial scouts. But in order to be of any real value such a ship must be a great vessel with enormous deck space and with a speed equal to that of the fleet. The probable cost of 15,000,000 francs would hardly be justified, even if the number of cruisers were reduced. Besides, such expense is not necessary. Modern battleships of the largest size can easily provide space for the launching and landing of aeroplanes without interference with essential features of design or great expense. In addition, an aeroplane can easily be taken apart and stowed below if it be desired to keep it aboard during action—this is hardly probable, however. At any rate, the problem of rising from a ship's deck and landing upon it is now being studied by able minds, and we can expect a practical solution at any time."

My opinion of the "*garage vessel*" is registered in the discussion, page 745, as follows: "Furthermore, the use of a garage vessel would add another of the needless auxiliaries, which according to his reasoning should be avoided."

The ingenious author of the newspaper hoax, referred to primarily, states that "the first hangar ship shall be of size, cruising radius and speed sufficient to enable it to maintain its proper place with either a battleship fleet or a fast scout cruiser squadron. The idea is that aeroplanes may be used far in advance of the actual fighting units, in which case they should, it is said, be carried on a vessel attached to the scouts rather than the real fighters. On this account great speed will be necessary for the hangar ship."

Other details he gives, but the more they are analyzed, the more it becomes apparent that the ideal "hangar ship" is the ideal scout itself. Certainly the scout must have no peer in speed and it would surely be out of the question for one such ship to be of any use in supplying aerial accessories to a dozen or more scouts scattered over an extensive scouting line.

Now it has been my idea from the beginning that all scouts should be supplied with naval aeroplanes and fitted to use them, just as soon as we can determine exactly what is needed for the fittings. This is the idea that prompted the use of the scout "Birmingham" for the first demonstration in flying from a ship.

I go further, however, in believing that all large ships, battleships and armored cruisers, should be supplied with naval aeroplanes, for which there are many important uses other than scouting. But the most urgent reason for placing them on the larger ships first, as soon as practicable, is that it is only by having the aeroplane right in the midst of the fleet, in the company of the officers and mechanics who must be made as familiar with it as they are with guns and boats, that we can expect to instruct and exercise our people in its use and thereby study its efficiency for our purposes.

The French have designated the "Foudre" as a sort of base hangar for purposes of instruction. Were we to adopt this policy, it would mean the use of any old hulk that could be spared and we would still be confronted with the difficulty of providing the officers and men to man her and the people to receive the instruction away from the ships to which they belong. Furthermore, the policy that I advocate is to have this instruction going on at every suitable place where the fleet is apt to assemble, in whole or in part, periodically or permanently.

One "Foudre" could not be in all these places at once and the supplies that she is supposed to carry would be more conveniently carried on board of the necessary auxiliaries, such as the fuel ships, the transports and the repair ships.

In view of our difficulties in getting battleships and essential auxiliaries from Congress, I hope the misguided author of this newspaper hoax will endeavor to correct the false impression that he has created concerning this absolutely impossible special "hangar ship."

However, I do not wish to attribute any but the best of intentions to this author, although he ruffled me a bit by committing me to a preference for the products of a certain factory. But I feel that he must have good intentions because he places me in the category of a "*young* officer," and I am led to hope that it is because he has in mind an essay that I wrote for the U. S. Naval Institute in 1884. I was young then, but, on page 30, Volume XI, may be found the following precept:

"The great secret in naval economy, which many nations have yet to learn, is *to maintain nothing superfluous or inefficient.*"

I am still young enough to stand by that sentence written twenty-eight years ago and, therefore, I do not believe in the "hangar ship."

Growth of the Automobile Industry

THE best way of presenting dry statistics in a form that is both interesting and quickly comprehensible is to use a graphic comparison. Some idea of enormous quantities can thus be readily grasped. Last year the automobile manufacturers of the United States produced 209,000 cars. But how could we possibly show a picture of this vast number of automobiles in the SCIENTIFIC AMERICAN and have room for anything else in the same issue? We are forced by circumstances to fall back upon the common method of showing bulk rather than numbers. We have therefore shown in our front page illustration a single car representing the entire output for the year. In other words, if all the material used in the automobiles manufactured last year were put into a single car, the giant product would be 59 times as long, 59 times as high and 59 times as wide as an average machine. Our giant car would tower to a height of 442 feet, or within 100 feet of the top of the Municipal Building which is now being

REDUCE FRICTION

In the end friction destroys all motors

Without friction your motor would never wear out.

Friction slowly but steadily wastes the power and wears the moving parts of automobile motors. This accounts for their short life.

To reduce this friction you should secure the nearest possible approach to perfect lubrication.

That involves the quality of your lubricating oil and its fitness for your motor.

Different types of motors demand different grades of oil.

The spring-strength of the piston rings must be considered; the fit of the piston into its recess; the length of the crankshaft and connecting-rod bearings; the feed system; the length of the vacuum period, while intake and exhaust valves are both closed.

Before correct lubrication can be determined, these and other important considerations, must be dealt with.

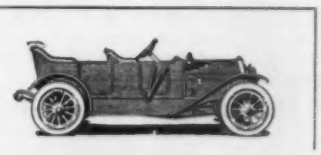
In producing Gargoyle Mobiloils we studied the construction of every American automobile and many foreign makes.

We have drawn up a list of recommendations, showing the correct grade of Gargoyle Mobiloil for these various cars.

A partial list is printed on the right. The complete list will be mailed you on request.

These oils and recommendations come from the Vacuum Oil Company, recognized by power-engineering circles throughout the world as the authoritative leaders in lubrication.

The oils specified will give the nearest approach to perfect lubrication that you can secure.



A guide to correct Automobile lubrication

Explanation: In the schedule the letter opposite the car indicates the grade of Gargoyle Mobiloil that should be used. For example, "A." means "Gargoyle Mobiloil A." "Arc." means "Gargoyle Mobiloil Arctic." For all electric vehicles use Gargoyle Mobiloil A. The recommendations cover both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1908 Summer	1908 Winter	1909 Summer	1909 Winter	1910 Summer	1910 Winter	1911 Summer	1911 Winter	1912 Summer	1912 Winter
Abbott Detroit	...	...	...	...	A	Arc.	A	Arc.	A	Arc.
Alco	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
American	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Apperson	E	E	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Atlas	A	A	E	E	E	E	E	E	A	A
" Com'l	...	...	E	E	E	E	Arc.	Arc.	A	A
Austin	A	A	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Autocar (2 cyl)	B	A	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (2 cyl) Com'l	...	...	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (4 cyl)	A	E	A	E	A	E	A	Arc.	A	Arc.
Benz	...	...	A	A	A	A	A	A	A	A
Bergdoll	...	...	...	...	A	Arc.	A	Arc.	Arc.	Arc.
Brush	A	A	A	E	A	E	A	E	A	E
Buick (2 cyl)	A	A	A	A	A	A	A	A	A	A
" (4 cyl)	A	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Cadillac (1 cyl)	A	E	A	A	...	...	...	...	...	...
" (4 cyl)	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Carterear	A	E	A	A	A	E	A	E	A	E
" Com'l	B	A	A	A	A	E	A	Arc.	A	Arc.
Case	...	...	...	...	A	A	A	Arc.	A	Arc.
Chadwick	A	A	A	A	B	A	A	Arc.	A	Arc.
Chalmers	...	...	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Chase	B	B	B	B	B	B	B	B	A	A
Cole	...	...	Arc.	Arc.	Arc.	Arc.	A	Arc.	Arc.	Arc.
Columbia	A	E	A	E	E	E	A	A	A	A
Columbia Knight	...	...	...	...	...	...	...	...	A	A
Couple Gear	A	A	A	A	A	A	A	A	A	Arc.
Croxton-Keetos	...	...	...	...	A	Arc.	A	Arc.	Arc.	Arc.
Daimler	A	E	A	E	A	E	A	E	A	A
Daimler Knight	...	...	...	...	...	...	A	E	A	A
Darracq	A	E	A	E	A	E	A	E	Arc.	Arc.
De Dion	B	A	B	A	B	E	B	A	A	A
Delahaye	B	A	B	A	A	A	A	A	A	A
Delaunay-Belleville	B	A	B	A	B	A	B	A	B	A
Elmore	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
E. M. F.	...	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Fiat	A	E	B	E	A	E	A	E	A	A
Flanders	...	...	...	...	E	E	E	Arc.	Arc.	Arc.
Ford	A	E	E	E	A	Arc.	E	E	E	E
Franklin	B	E	B	A	B	A	B	A	A	Arc.
" Com'l	B	E	B	A	B	A	B	A	A	Arc.
Gramm	...	...	...	...	...	...	A	A	A	A
Gramm-Logan	...	...	A	Arc.	A	Arc.	...	...	...	...
Hewitt (2 cyl)	...	...	A	A	A	A	A	Arc.	...	...
Hewitt (4 cyl)	A	A	A	E	A	E	A	Arc.	E	E
Hudson	...	...	...	...	Arc.	Arc.	A	Arc.	A	Arc.
Hupmobile	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
International	B	A	B	A	B	A	B	B	A	A
Interstate	...	...	A	E	A	E	A	Arc.	A	Arc.
Isotta	A	E	A	A	A	A	A	A	A	A
Italia	...	...	A	A	A	A	A	A	A	A
Jackson (2 cyl)	A	A	A	A	A	A	...	...	...	...
" (4 cyl)	A	E	A	E	A	Arc.	A	Arc.	A	Arc.
Kelly	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Kissel-Kar	A	E	A	E	A	E	A	Arc.	A	Arc.
" Com'l	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Kline Kar	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Knox	B	E	B	A	B	A	B	A	B	A
Krit	...	...	...	...	A	A	A	A	A	A
Lambert	A	E	A	A	A	Arc.	A	Arc.	A	Arc.
" Com'l	A	E	A	A	...	...	A	A	A	E
Lancia	B	A	B	A	B	A	B	A	B	Arc.
Locomobile	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Lozier	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Mack	A	A	A	E	A	E	A	E	A	E
Marion	A	A	A	E	A	E	A	E	A	Arc.
Marmon	B	E	Arc.	Arc.	A	E	A	Arc.	Arc.	Arc.
Matheson	A	E	Arc.	Arc.	Arc.	Arc.	A	E	E	E
Maxwell (2 cyl)	E	E	E	E	E	E	E	E	E	E
" (4 cyl)	...	...	E	E	E	E	Arc.	Arc.	Arc.	Arc.
Mercedes	A	E	A	E	A	E	A	E	A	E
Mercedes Knight	...	...	...	...	...	...	A	E	A	E
Mercer	...	...	...	...	A	Arc.	A	Arc.	A	Arc.
Minerva Knight	...	...	...	...	...	...	A	A	A	A
Mitchell	A	E	A	A	Arc.	Arc.	A	Arc.	A	Arc.
Moon	A	E	A	E	A	E	Arc.	Arc.	Arc.	Arc.
National	A	E	Arc.	A	A	A	A	A	A	A
Oakland	...	...	A	E	A	E	A	Arc.	A	Arc.
Oldsmobile	A	E	A	E	A	E	A	Arc.	A	Arc.
Overland	A	E	A	E	A	Arc.	A	Arc.	Arc.	Arc.
Packard	E	E	Arc.	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Panhard	A	E	A	E	A	E	A	E	A	A
Panhard Knight	...	...	...	...	...	...	A	E	A	A
Peerless	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pennsylvania	A	E	A	E	A	E	A	A	...	...
Pierce Arrow	A	E	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
" Com'l	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Pope Hartford	A	E	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Rambler	A	E	A	A	A	A	A	Arc.	Arc.	Arc.
Rapid	A	A	A	A	A	A	A	Arc.	Arc.	Arc.
Regal	...	...	A	E	A	E	A	Arc.	A	E
Renault	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	A	A	A	A	E	A	Arc.	A	Arc.
Royal Tourist	A	E	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Selden	A	E	A	E	A	E	A	E	Arc.	Arc.
Simplex	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Speedwell	...	...	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Stanley	D	D	D	D	D	D	D	D	D	D
Stearns	A	E	A	A	Arc.	Arc.	A	Arc.	A	Arc.
Stearns Knight	...	...	...	...	...	...	...	...	A	A
Stevens Duryea	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Stoddard Dayton	...	...	E	E	Arc.	Arc.	A	A	A	A
Stoddard Dayton-Knight	...	...	...	...	...	...	...	...	A	A
Thomas	A	E	E	E	E	E	E	A	E	E
Walter	A	E	A	E	A	E	Arc.	Arc.	Arc.	Arc.
Welch	A	E	A	E	A	E	...	...	...	...
Welch Detroit	...	...	...	...	...	...	A	E	...	...
White (Gas)	...	...	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (Steam)	D	D	D	D	D	D	D	D	D	D
Winton	A	B	E	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.

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The Right of All the Way

Railroad service and telephone service have no common factors—they cannot be compared, but present some striking contrasts.

Each telephone message requires the right of all the way over which it is carried. A circuit composed of a pair of wires must be clear from end to end, for a single conversation.

A bird's eye view of any railroad track would show a procession of trains, one following the other, with intervals of safety between them.

The railroad carries passengers in train loads by wholesale, in a public conveyance, and the service given to each passenger is limited by the necessities of the others; while the telephone carries messages over wires devoted exclusively for the time being to the individual use of the subscriber or patron. Even a multi-millionaire could not afford the exclusive use of the railroad track between New York and Chicago. But the telephone user has the whole track and the right of all the way, so long as he desires it.

It is an easy matter to transport 15,000 people over a single track between two points in twenty-four hours. To transport the voices of 15,000 people over a single two-wire circuit, allowing three minutes for each talk, would take more than thirty days.

The telephone system cannot put on more cars or run extra trains in order to carry more people. It must build more telephone tracks—string more wires.

The wonder of telephone development lies in the fact that the Bell System is so constructed and equipped that an exclusive right of all the way, between near-by or distant points, is economically used by over 24,000,000 people every day.

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The Carborundum Company
Niagara Falls, New York

erected alongside the Brooklyn Bridge. We have had to show this car head-on in the picture, because our page is too narrow for a side view.

The actual number of automobiles in use in 1911 is estimated at 677,000. These, if put into a single car, would make one 660 feet high, and we would scarcely have room on our front page for even a head-on view of the machine.

Though comparisons of bulk are very convenient, we must confess that they do not convey an adequate idea, particularly in products of the nature of automobiles, whose value is represented by the work done upon them rather than by the quantity of material used in them. According to a recent Census Report, the value of the automobile industry in 1909 stood at $249,202,000 for the product and for the value added by manufacture $117,556,000, and in this particular it ranks seventeenth among the big American industries. The same report gives the number of wage earners employed in the manufacture of motor cars, bodies and parts, as 75,721. Our comparison falls short when it comes to showing the number of wage earners and the value of the product. It will be readily apparent to anyone that the giant automobile made up of materials that went into all the automobiles manufactured last year would have a far smaller superficial area and consequently much less hand or machine finished surface than that of all the automobiles considered individually. Consequently, there would be far less labor involved in the making of this huge automobile and the value added to the product by manufacture would be much less proportionately.

The Census Report just referred to gives the per cent of increase of all the big American industries from the year 1899 to 1909. Only fourteen industries show an increase in output of more than 100 per cent, but the motor car industry shows an increase of 5,148.6 per cent in value of product and 3,278.9 per cent increase in number of wage earners. The next best industry in the latter particular is that of electrical machinery, apparatus and supplies which shows a percentage of 107.7, while the second best as regards value of products is 155 per cent shown by the copper, tin, sheet-iron products.

The automobile industry may now be said to have passed its period of infancy and adolescence, and attained an age of maturity. Hitherto there have been such marked changes in design from year to year, that car owners were constantly discarding their old cars and buying new ones. Now the automobile has reached a standard form. Such new developments as are found in the annual catalogue relate to non-essentials and minor details. The man who buys a car to-day may be assured of a machine that will last him for a number of years without growing hopelessly out of date. In the next ten years, therefore, we cannot look for anything like the increase in production that was shown in the decade just past. Despite this fact, however, the automobile industry has not yet reached the peak of maximum production. Our esteemed contemporary, the *Automobile*, after writing to the automobile manufacturers of the country for confidential reports of their output last year and their probable output this year, obtained the figure for 1911, which we have already given as 209,957 cars, and the probable output for 1912 as 247,427 cars. The production of cars in the first two or three months of the year is always higher than for corresponding periods during the balance of the year. In January last 58,422 cars were produced as against 28,581 in January, 1911, and in February of this year 70,242 as against 34,265 last year. Very evidently the estimate of 40,000 odd cars more than last year on the total year's production is not at all too large.

How can this enormous production of cars be disposed of if we accept the estimate of 677,000 automobiles now in use, or one in every 140 of the population? This estimate by the way was very carefully compiled by the *Automobile* and is as reliable as any that can possibly be made. The answer is to be found in our front-page

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PATENTS

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POST CARDS of Irish Scenery, Irish Life, Irish Antiquities. Cards of any place in the "Old Country". Lighthouses, 200 subjects, domestic and foreign. Catalog and sample card, five cents. Strain (S A). "The Lighthouse", Belfast, Ireland.

MISCELLANEOUS

MODEL AND FINE CLOCK TRAIN WORK. Estimates given. Work done by the hour or by contract. Waltham Clock Company, Waltham, Massachusetts.

FREE SAMPLE goes with the first letter. Something new. Every firm wants it. Orders from $1.00 to $100.00. Nice pleasant business. Big demand everywhere. Write for free sample. Metallic Mfg. Co., 438 N. Clark, Chicago.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated. MUNN & CO., Inc.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9256.—Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257.—Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9261.—Wanted, a manufacturer to make card games.

Inquiry No. 9262.—Wanted, to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Inquiry No. 9263.—Wanted, name and address of manufacturer of pantaloon stretchers with clamps, which is capable of being folded up.

Inquiry No. 9264.—Wanted, the name and address of manufacturers of Date Pitting Machines.

Inquiry No. 9265.—Wanted, names and addresses of manufacturers of machinery for making picket fences.

Inquiry No. 9266.—Wanted, to buy machinery for fastening wire cloth to wooden frames with coppered tacks.

Inquiry No. 9267.—Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9273.—Wanted, to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9274.—Wanted, the name of a manufacturer of a machine to make cushion covers for fruit crates.

Inquiry No. 9275.—Wanted, name and address of manufacturer of stock patterns of platen job printing presses.

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00.

Inquiry No. 9277. Wanted. A machine for packing dry batteries.

Inquiry No. 9278. Wanted. A machine for separating crab meat from the shell.

Inquiry No. 9279. Wanted. A machine for shredding asbestos board.

Inquiry No. 9281.—Wanted to buy machinery for bleaching walnuts and ivory nuts.

Carry This Pen in your White Vest

YES, upside down in your white vest pocket.

Or slip it in your trousers pocket along with your jack knife and keys.

Or drop it in the bottom of your outside coat pocket.

In short, carry it in any of the hundred places where you expect a fountain pen to leak.

That's why it is called the Parker Jack Knife Safety Pen—because you can carry it anywhere your jack knife can be carried, and it won't leak a bit more than your jack knife leaks. Neither will it slip out of your pocket when you stoop over.

Every automobilist should have one in the outside pocket of his duster. Every professional man, every travelling man, every tourist, every vacationist, every lady who goes shopping should carry one. Handy as a pencil, slips flat into purse or bag.

Many sizes and handsome styles, from 3¼ inch *pen knife* size for ladies to 5¾ inches long for the man who wants a full size pen to grip. Prices $2.50, $3.50, $4.00, $5.00 and upwards.

A scientific principle keeps the Parker Jack Knife Pen from leaking. It contains the Capillary Attraction principle which makes every Parker Lucky Curve Fountain Pen write as smooth as glass, and never leak or "sweat" in your pocket.

Parker Spear Head Ink Controller gives absolutely uniform and easy ink flow. 14k gold pens with polished Iridium points write without hitch, skip or blot.

No. 14 Silver Mounted $5.00

No. 23½ Chased Barrel $3.00

Get a Parker from your dealer on 10 days trial. If you don't find it the handiest writing contrivance you ever saw, dealer will promptly refund. We protect him from loss.

If your dealer does not carry Parker Pens, write us for catalog. But start getting a Parker *today*.

PARKER PEN COMPANY
85 Mill Street, Janesville, Wisconsin
New York Retail Store
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PARKER
Jack Knife Safety
FOUNTAIN PEN

FOR BETTER TECHNICAL PHOTOGRAPHS USE
'TABLOID' and 'RYTOL'
(Trade Mark) *(Trade Mark)*
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BURROUGHS WELLCOME & CO.
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Write for Free Specimen

OUT ON FIRST

Be the star player in your nine by using "3-in-One." Preserves and softens the leather so the ball sticks right in the hole. Don't spit on the ball, use "3-in-One;" won't make ball sticky, and will make it curve better. "3-in-One" makes your bat hit harder, keeps it from cracking. Sample bottle FREE. 3-IN-ONE OIL COMPANY, 42 A Z G Broadway, New York City.

Veeder Counters

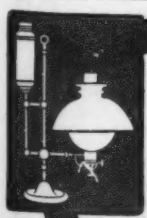
to register reciprocating movements or revolutions. Cut full size. Booklet Free.

One manufacturer says: "We have already been able by the installation of a bonus system, made possible by your counters, to raise our production 10 to 15 per cent."

Price $1.00

VEEDER MFG. CO.
18 Sargent St. Hartford, Conn.
Cyclometers, Odometers, Tachometers, Counters and Fine Castings.

Represented in Great Britain by Markt & Co. Ltd., 6 City Road, Finsbury Sq., London, E.C. France, by Markt & Co. Ltd., 107 Avenue Parmentier, Paris; Germany, Austria-Hungary and Scandinavian Countries by Ludw. Loewe & Co., Hutten Strasse 17-20, Berlin.



2¢ A WEEK

A safe, very brilliant, powerful, steady, white light. Is better than electricity or acetylene and cheaper than kerosene.

Every lamp is a complete self-contained miniature light works.

Clean—bright—odorless—portable. Made in over 200 styles for every purpose. Fully guaranteed. Catalog free. Agents wanted.

THE BEST LIGHT CO.
87 East 5th Street
Canton, O.

THE "BEST" LIGHT.

illustration which shows what an enormous export business is now being done. The automobile was introduced into this country from abroad, but while we used to import large numbers of cars, the imports are now dwindling very rapidly. In the year 1909, 1,645 cars were brought into the country. The next year the import dropped to 1,024, and last year it fell below the 1,000 mark to 972. In the same year our export grew rapidly. In 1909 we shipped out of this country 4,686 cars; in 1910, 8,443 cars, and last year the figures leaped to a total of 15,807. These quantities are shown in the illustration by single cars representing the import and export, respectively, for the different years. It will be observed that the car for 1911 is quite a sizable one compared to the total production of the year. Our illustration also shows the amount of money paid out for imported machines and the amount taken in on exported machines for the same year. This money represents the actual value of the cars and does not take into account large sums taken in for the export of automobile parts and tires. Most of last year's products went to Canada, which took nearly 5,000 automobiles at a value of $5,500,000. Large quantities were also exported to Great Britain, particularly the smaller cars. Census figures place the total at 4,021, valued at $3,380,266.

An advance bulletin just sent out by the Bureau of Statistics places the probable total of exports for the fiscal year ending June 30th, 1912, at $27,000,000 worth of automobiles and accessories parts. During the ten months ending with April 17,000 automobiles have been exported, worth about $16,500,000; and adding to this the value of automobile parts, engines, tires, etc., we have $22,000,000 for the ten months. Only one country in the world exceeds us in exports of automobiles. France sent abroad $24,640,000 worth in 1908 and her trade grew to $31,700,000 last year. In the same period of time our exports grew from $5,000,000 to $20,000,000, and in all probability the United States will take premier position within the next two or three years.

The value and cheapness of the American product is being recognized throughout the world. American automobiles are sold in all European countries and the market is increasing every year. We have an excellent opportunity to sell machines in South America and no doubt this field will be cultivated from now on. It seems, therefore, that although we at home are beginning to use our cars for longer periods and are satisfied with second-hand cars, there will be no curtailing of the output of the automobile manufacturer for a long time to come.

Resuscitation from Electrical Shock

(Concluded from page 52.)

Seattle, in June, and adopted, but are still subject to any improvement that may be suggested and is really worth adoption. The booklet rules include a section on the "First Case of Burns," and are to be issued in a flexible cloth cover.

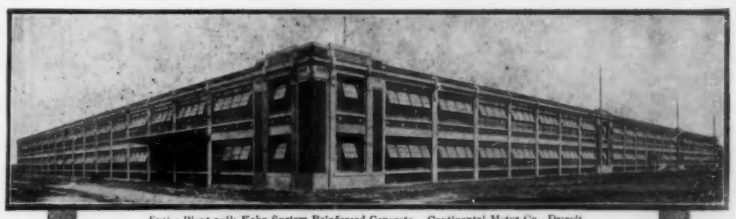
Two other important subjects still remain for disposition. One of these is the approval or recommendation of devices for continuing artificial respiration. The commission has already examined some of the devices obtainable, and will report its conclusions later. It believes thoroughly in the desirability of a practical apparatus which will furnish thorough ventilation of the lungs, for even the best manual treatment may be far from satisfactory or infallibly efficacious. One of these devices has, it is said, proved very effective in its treatment of the lower animals.

But there is left the third great work of the commission. It has followed Goethe's advice in attacking the question that was next or nearest at hand, and has laid down rules that will save many valuable lives. The third task of the commission is an investigation of the possibilities of restoring the fibrillating heart of a shocked person to its natural pulsation. On this part of the subject, Dr. Cannon, president of the commission, in his preliminary official report says: "The electric current may kill

WINCHESTER
Rifles and Cartridges

A man who travels the distance and incurs the expense generally necessary to get into big game hunting country should not run the risk of having his time, money and effort all go for naught by taking a rifle or cartridges that may fail him at the supreme moment. The surest way to guard against such a disappointing experience is by equipping with a Winchester rifle and Winchester make of cartridges. They come as near to being infallible as guns and ammunition can be made. Not only are they dependable, but they are made in calibers suitable for hunting all kinds of game. Remember

THE RED W BRAND NEVER DISAPPOINTS



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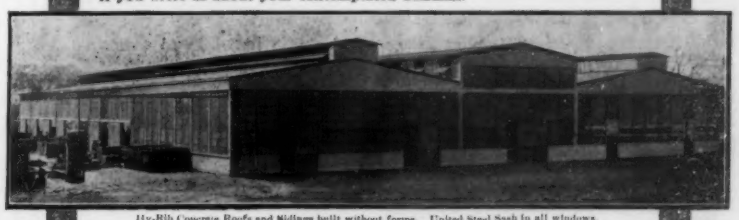
Embrace all constructions, including reinforced concrete, stucco, metal lath, steel windows, waterproofing, finishes, steel specialties, etc. Kahn Buildings are found the world over, and represent maximum *fireproofness, daylightness, strength, safety* and *economy*. Our experience covers thousands of the most carefully planned buildings, and is at your service without cost if you write us about your contemplated building.



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Hy-Rib Hy-Rib

Does away with forms in concrete construction. Makes best roofs, Sidings, Floors, Partitions, Ceilings. Better and more economical than brick, corrugated iron or wood. Hy-Rib steel sheathing is a combined unit of reinforcement, centering, studs and lath. Hy-Rib Hand Book of valuable suggestions, specifications, etc. Free, if you mention your building.

Perfect Daylighting with United Steel Sash and Kahn Flat Ceiling Construction. Dodge Bros., Detroit.

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PIVOTED SASH
CONTINUOUS SASH

United Steel Sash

MOVABLE PARTITIONS
UNITED STEEL DOORS
CASEMENT SASH

KAHN Building Products — TRUSSED CONCRETE STEEL CO.

Improved types of sash for all openings. Machine built of rolled steel—unweakened by cutting or punching. Flood interior with daylight. Proof against fire and storm. Cannot warp, rot or wear out. United Steel Sash Catalog, showing complete details, illustrations, etc. Free, if you write us about your building.

KAHN Building Products — TRUSSED CONCRETE STEEL CO.

Trussed Concrete Steel Co., 902 Trussed Concrete Bldg. Detroit, Mich.

THE WONDERS OF CHEMISTRY

¶ "Where will you find a young man whose curiosity and interest will not immediately be awakened when you put into his hands a potato," said the great Pasteur over fifty years ago, "when with that potato he may produce sugar, with that sugar, alcohol, with that alcohol, ether and vinegar? Where is he that will not be happy to tell his family in the evening that he has just been working out an electric telegraph? And, gentlemen, be convinced of this, such studies are seldom if ever forgotten. It is somewhat as if geography were to be taught by traveling; such geography is remembered because one has seen the places. In the same way your sons will not forget what the air we breathe contains, when they have once analyzed it. When in their hands and under their eyes the admirable properties of its elements have been resolved."

¶ More astounding than ever are the achievements of the modern chemist—more astounding than even Pasteur dreamed. Who would have thought that rubber—real rubber—could be made out of turpentine, out of potatoes, out of coal tar—three widely different substances? Who would have thought, twenty years ago, that sugar, steel, flour, almost every article of necessity, would in this year nineteen hundred and twelve be made not by haphazard rules of thumb in a factory, but by trained chemists, armed with instruments of precision, with test tubes, and retorts? Who would have thought that even the time honored art of cooking would be reduced to a chemical basis and that the kitchen would become a kind of laboratory? That the broiling of a steak or even the mere poaching of an egg would become a matter of chemical concern?

¶ The next mid-month number of the Scientific American which will bear the date August 17, will present some of these marvels. Only the business side of the chemist's activity will be dwelt upon; for here in the last few years amazing results have been achieved.

¶ Price fifteen cents on all newsstands.

The Gyroscope

The mysterious behavior of the gyroscope is a source of wonder to everyone. From a curious toy, the gyroscope is being developed into a device of great practical value. Its theory and its method of action are set forth up to the latest moment in the Scientific American Supplement. The following numbers are of great interest and usefulness:

Scientific American Supplement 1501—Treats of the Mechanics of the Gyroscope. A clear explanation without mathematics.

Scientific American Supplement 1534—"Little-known Properties of the Gyroscope" describes a peculiar action not generally observed, and discusses the effect of this property upon the motions of the planets.

Scientific American Supplement 1621—The Gyrostat for Ships describes the construction and application of the principle to prevent rolling of vessels.

Scientific American Supplement 1643—The Gyroscope for Balancing Aeroplanes, takes up this interesting field, which the gyroscope alone seems capable of occupying.

Scientific American Supplement 1645—The Theory of the Gyroscope, is an excellent article, treating the subject mathematically rather than popularly.

Scientific American Supplement 1649—The Gyroscope, is an article giving a full discussion of the instrument without mathematics, and in language within the comprehension of all interested.

Scientific American Supplement 1694—Gyroscopic Apparatus for Preventing Ships from Rolling, takes up the Schlick invention described first in No. 1621, and discusses its action and results fully.

Scientific American Supplement 1716—A Recent Development in Gyroscopic Design, illustrates a new form of gyroscope and mounting adapted to engineering uses.

Scientific American Supplement 1741—Gyroscopic Balancing of Aeroplanes, tells of various suggested methods of maintaining equilibrium.

Scientific American Supplement 1773—The Wonderful Gyroscope, gives diagrams of the gyroscope and its action, and applications to maintaining stability of ships and monorail trains.

Scientific American Supplement 1814—The Regnard Aeroplane, describes the latest design of aeroplane stabilizer, from which great things are expected.

Each number of the Supplement costs 10 cents. A set of papers containing all the articles here mentioned will be mailed for $1.10. Send for a copy of the 1910 Supplement Catalogue, free to any address. Order from your newsdealer, or the publishers

Munn & Co., Inc., 361 Broadway, New York, N. Y.

either by temporarily paralyzing the nervous control of the muscles of respiration, or by stopping the regular beat of the heart. When the heart is seriously affected, it ceases to contract as a whole, but continues to contract in parts here and there, so that it appears to quiver. It is then said to 'fibrillate.' In this condition the heart fails to keep the blood circulating, and death quickly results. At present no practical procedure has been discovered which will restore the regular beat of the heart in man after it begins fibrillating. The chief hope of resuscitation for the present lies in proper treatment of the cases of paralyzed respiration, and the immediate necessity in these cases is promptness in applying artificial respiration and continuance of the process until natural breathing returns. In some instances, however, the heart may be merely weakened without being made to fibrillate; then again artificial respiration may be of vital importance, because a greatly weakened heart leads to impairment or total stoppage of respiration, which in turn destroys the last vestige of the heart beat. In all cases, therefore, an attempt should be made to restore natural breathing." Here, then, is a grave problem that has heretofore defined all the resources of medical science. While the efforts of this notable commission may once more be attended with failure, it is well that the attempt is again put forth to win such a boon for mankind. Electricity has done so much to change the older conditions of life and civilization, one is sometimes tempted to appropriate to it the inspired saying: "Behold, I make all things new;" and certainly it never had a nobler field of effort than this to which that progressive body, the National Electric Light Association, has pledged its financial and inventive resources.

Blowing Up a Locomotive Boiler

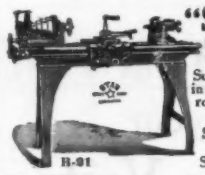
(Concluded from page 59.)

uated water gages were mounted on the back head of the boilers, and these were read through a telescope which was mounted on the crest of the bomb-proof. Each boiler was brought to a condition corresponding to its regular operation in railroad service, when it has an estimated maximum power of fourteen hundred horse-power, which is equivalent to that required to haul a heavy passenger train sixty miles per hour. The supply of feed water was then shut off, all the other conditions remaining unchanged.

The water level, under the control of the operators, gradually fell, exposing the crown sheet and other portions of the heating surface to the full effects of the fire. Under normal conditions, these surfaces are protected from over-heating by contact with the water; but in these tests the lowering of the water level deprived the plates of this protection and they became red hot.

The boiler with the Jacobs-Shupert firebox was continuously tested under these severe conditions for fifty-five minutes, without developing any failure, notwithstanding the fact that the level of the water fell to a point more than twenty-five inches below the crown sheet. It may have fallen lower, but the water gage glass did not read below twenty-five. The test was then discontinued because the small amount of water remaining did not evaporate sufficiently fast to supply the draft necessary to maintain the fire. At the conclusion of the test, the firebox was apparently in good condition and ready for further service.

The ordinary radial-stay boiler was then tested under conditions identical to those above described. After the test had been in progress for twenty-three minutes, and the water level had fallen to 14½ inches below the crown sheet, an explosion occurred. The crown sheet and the stays which hold it in place, having become highly heated, pulled away from each other and released the pressure in the boiler. The discharge of steam was through the firebox, and the force of the explosion threw parts of the furnace in all directions, and proved sufficient to lift



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For Foot or Power **LATHES**
Suitable for fine accurate work in the repair shop, garage, tool room and machine shop.
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High Quality Low Prices Catalog Free
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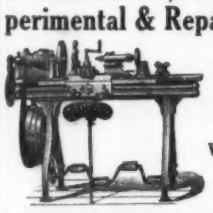
***For* Gunsmiths, Tool Makers, Experimental & Repair Work, etc.**



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Power, Foot & Electric Drive
Interesting Catalog Free
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I wish to purchase a medium size Modern Machine Shop with good equipment and will pay a CASH REWARD for first information as to where same can be found. Address "Shop," Box 773, New York.

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A drop forged steel plier that is absolutely guaranteed. Quality is the best it is possible to produce. Your local hardware dealer has it. If not we will send you one only sample pair of 8" postpaid for $1.00.
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The tough, sharp crystals of a Pike India Oilstone just *eat* steel. It's fun to see how quickly they put a dandy, keen edge on carvers, kitchen knives, tools, etc. No other stone cuts so fast without losing its shape. Adopted now by manual training schools, big machine shops, etc. Nothing like it. This is only one of the famous

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Let us mail you a Pike India Vest Pocket Stone for pocket knives, office use, etc. Just send your dealer's name and 4c. for packing and mailing. We'll include *"How to Sharpen"* greatest book ever written on sharpening and how to select and care for oilstones. You'll be pleased. Write today.

PIKE MANUFACTURING CO.
106 Main St., Pike, N. H.

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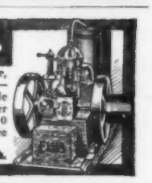

Run on gasoline, kerosene, distillate, any cheap fuel oil. Cost less to run—develop more power. Patent throttle gives *three engines in one.* Many other exclusive features—guaranteed 10 years—we pay freight—30 days' free trial. Send for catalogue today.
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One gallon of Oildag will do the work of three or four gallons of oil. It is put up in concentrated form for charging 1, 5, 10 or 90 gallons of oil. You simply mix it with the oil you use regularly. It is very superior for Farm, Factory, Automobile, Motor Boat and Motorcycle use. Ask for Booklet L-458.

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We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.
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Stop! Read! and Consider!!
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the entire boiler, weighing forty tons, several feet above its foundation. The boiler was so damaged as to render its reconstruction necessary.

The steam pressure during the Jacobs-Shupert test varied between 215 and 225 pounds for the first twenty-seven minutes, and gradually dropped thereafter until it reached fifty pounds at the end of the test. The steam pressure on the radial boiler varied between 200 and 230 pounds, being 228 pounds when failure occurred.

In the boiler which successfully withstood this severe ordeal the place of the radial staybolts is taken by a series of deep flanges, which extend from the outside boiler shell to the inner shell of the firebox. The firebox shell consists of a series of U-shaped channel sections which are riveted to the inside edges of these flanges. This affords an exceedingly strong construction. Not only does each U-section present an arched form well calculated to carry the pressure, but the very strong riveting of each section to the inner edge of the flanges presents an enormous amount of sectional area to withstand the shearing stresses which must be overcome before the crown sheet can be torn loose and crushed in.

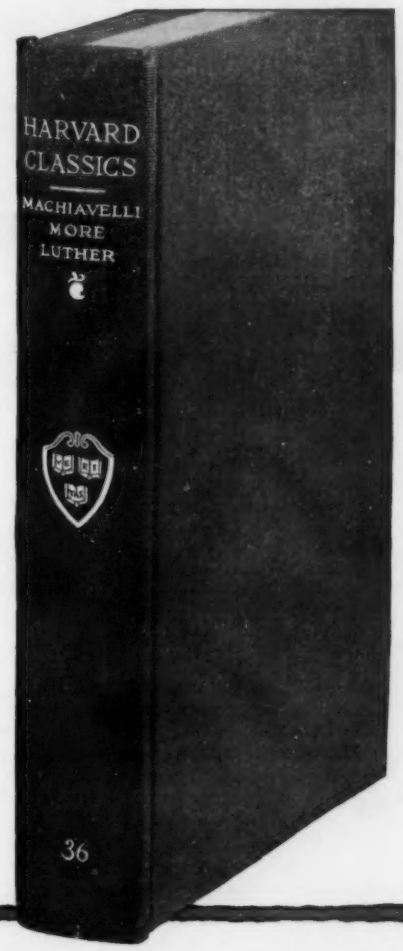
Luminous Phenomena Associated With Earthquakes

THERE is an old and widespread belief that great earthquakes are usually preceded, accompanied, or followed by various luminous phenomena, in the earth or the sky. These are sometimes described as vague illuminations of the air as a whole, glows and flashes of undefined source, phosphorescent clouds, etc.; or more definitely as lightning-like discharges (including fireballs), flames and columns of fire proceeding from the ground, and phenomena resembling shooting stars.

Prof. Ignazio Galli, of Rome, has taken the trouble to collect descriptions of these phenomena from all available sources, and has made them the subject of an elaborate memoir, originally published serially in the *Bolletino della Societa Sismologica Italiana*, and subsequently issued as a separate pamphlet of 230 octavo pages. The author cites textually 148 cases, dating from before the Christian era to the 20th century. Of 130 cases, 27 occurred by day and 103 by night. An analysis of 109 earthquakes shows that 52 were preceded, 37 accompanied, and 20 followed by luminous phenomena. In connection with the great Calabrian earthquake of 1905, such phenomena were reported from 42 localities, chiefly as having occurred before the earthquake.

Undoubtedly many of these phenomena were ordinary lightning flashes accompanying thunderstorms. When a quake occurs in a town, concomitant luminous phenomena may easily be explained as the result of fires breaking out in buildings, the sparking of crossed electric wires, etc. Other cases may be attributed to the ignition of subterranean gases, released by the rupture of the ground. There seems, however, to remain a minority of cases, especially when the luminous appearances preceded the earthquake, in which none of these explanations apply. As to the luminosity of clouds and fog, this phenomenon has often been reported, but by no means exclusively in connection with earthquakes.

Commenting on Galli's memoir in the *Comptes Rendus*, Comte de Montessus de Ballore, director of the Chilean seismological service, gives an analysis of 135 reports received in connection with the great Chilean earthquake of August 16th, 1906. After this earthquake question blanks were sent to all parts of the country, and among the items of information requested was a report as to the occurrence and character of luminous phenomena. Unfortunately for the particular object in question, severe thunderstorms prevailed in Chile at the time of the earthquake, and a majority of the luminous appearances reported must be attributed to ordinary lightning. The author does not consider the question whether these widespread thunderstorms might be themselves connected in some way with the earthquake.



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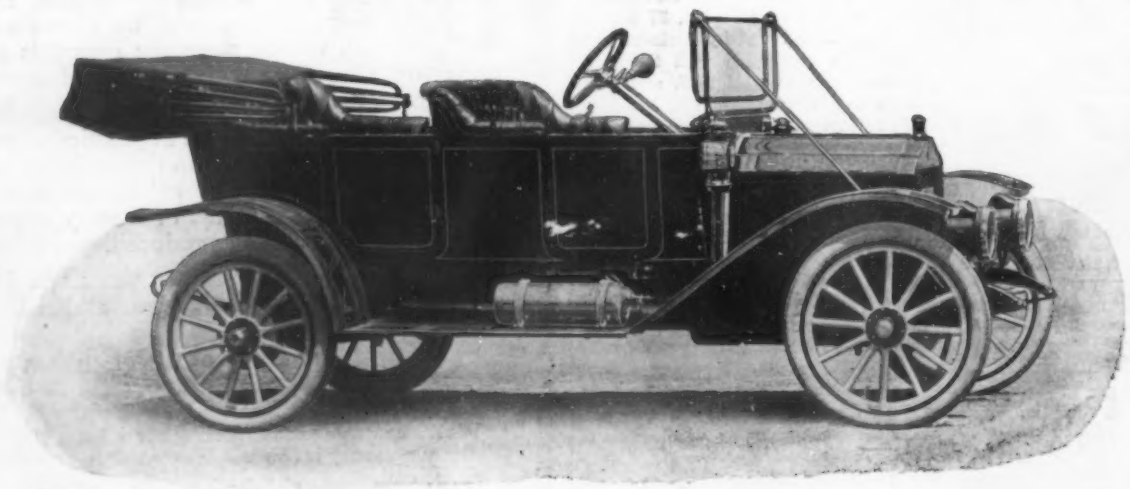

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